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AMCMS Code No. 5696.2300
USATECOM Project No. 8-WE-602-016-002
Report No. APG-MT-3350

FINAL REPORT ON ENGINEER DESIGN TEST OF 20-ROUND PLASTIC MAGAZINE FOR MI6A1 RIFLES

BY

FRANKLIN H. MILLER

OCTOBER 1969

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND

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AMCMS CODE NO. 5696.2300

(16) USATECOM [redacted]-8-WE-602/016/002

ENGINEER DESIGN TEST OF
20-ROUND PLASTIC MAGAZINE
FOR M16A1 RIFLES.

(9) FINAL REP[redacted]T, 12 Dec 68-26 Aug 69,

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(10) FRANKLIN H. MILLER

(11) OCT[redacted]69

(12) 118p.

(14) APG-MT-3350

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ABSTRACT

The third in a series of engineer design tests of 20-round plastic magazines for the M16A1 rifle was conducted at Aberdeen Proving Ground by the Materiel Test Directorate from 12 December 1968 to 26 August 1969. Equal numbers of test and control magazines were subjected to a series of comparative evaluations to determine function performance characteristics and material durability at -65°F, +155°F, and ambient range temperature (+70°F ± 30°F), and in adverse conditions of mud, sand, dust, and water. The test magazine material was checked for compatibility with various nonstandard solvents and lubricants. A displacement - time study was made of the magazines to determine cartridge positioning characteristics during firing. The test results reveal that the test magazine requires further design engineering to improve performance in adverse conditions and to increase material durability at low temperature.

FOREWORD

Materiel Test Directorate was responsible for conducting the test and preparing the test report.

ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND 21005

USATECOM PROJECT NO. 8 WE 602 016 002

FINAL REPORT ON ENGINEER DESIGN TEST OF
20-ROUND PLASTIC MAGAZINE
FOR M16A1 RIFLES

12 DECEMBER 1968 to 26 AUGUST 1969

SECTION 1. INTRODUCTION

1.1 BACKGROUND

The inception of the disposable magazine concept during 1967 was in response to an ENSURE requirement for a low-cost ($0.01 per round of ammunition contained) magazine capable of reliable one-time use in the M16A1 rifle. As a consequence of the initial evaluation of seven designs and subsequent selection, modification, and retest of two designs, it was determined that a disposable magazine could be made that approached the performance level of the standard item; however, the estimated production cost would exceed $0.20 for a 20-round magazine. A re-evaluation of the design concept and required use was made. The US Army Limited War Laboratory (USALWL) then entered into a redesign program to produce a magazine capable of performing as a reusable item, equal to or better than the standard 20-round aluminum magazine. The plastic magazine presently being evaluated at the direction of US Army Test and Evaluation Command (USATECOM) (Reference 6) is the product of this redesign program.

1.2 DESCRIPTION OF MATERIEL

The maximum capacity of the test magazine is 20 rounds of ammunition, vertically stacked in two adjacent rows of ten rounds each. The magazine body, follower, and floor plate are made of type 6-10 nylon with 50% fiber glass reinforcement. The rectangular-coiled follower spring is made of coated carbon steel wire. Position of the magazine when inserted into the weapon is regulated by a locking recess located on the left side of the magazine body.

During weapon firing the cartridges are alternately fed from the right and left sides of the magazine. The follower spring maintains pressure (transmitted through the follower) on the cartridge stack, properly positioning each round during feeding and, after the last round is fired, causes the follower to actuate the bolt stop.

1.3 TEST OBJECTIVE

The over-all objective of this evaluation was to determine the durability and functional reliability of the test item and to compare these data with those of the standard magazine.

1.4 SUMMARY OF RESULTS

1.4.1 Initial Inspection

The test and control magazines were uniformly manufactured; however, some dimensions were not within drawing specifications (see measurements in Appendix I).

Inspection of the test magazines revealed the following discrepancies in design and manufacture:

a. Allowable tolerances of the magazine body (inside width) and follower width at the points of contact with the magazine caused premature release of the last cartridge (round 20) during feeding (Reference 3 and paragraph 2.2.4).

b. Irregularities of material distribution and shrinkage in the floor plate resulting in incomplete formation of the lock detent (Figures 2.2-7 and 2.2-8).

c. Configuration of the magazine filler grooves required excessive force to be applied to the filler during its attachment and removal. This condition resulted in injury to the personnel loading the magazines (cut fingers). Position of the charger clips, which is regulated by the relative position of the filler to the magazine, was also affected when the filler could not be fully seated. Extreme care had to be exercised to prevent stacking two consecutively loaded rounds on the same side of the magazine. The double-stacking problem became increasingly aggravated with introduction of a redesigned follower (paragraph 1.4.4).

1.4.2 Extreme-Low Temperature (-65°F) Test

Compared to the USALWL disposable plastic magazines previously evaluated (Reference 2) the present test item was less durable. This difference is demonstrated by the drop-test damage shown in Figures 2.3-1 through 2.3-3. Since the failure to feed (FF) malfunctions were caused by a design deficiency which was recognized during initial inspection, these stoppages were not charged to the test magazine performance. There were no other test magazine malfunctions.

Control magazines had a total of five stoppages in addition to four magazines exhibiting nonfiring defects caused by the drop test. These defects did not cause malfunctions.

Because of the material damage and FF type malfunctions, the USALWL representative requested that testing be terminated after completion of the first firing cycle.

1.4.3 Extreme High Temperature (+155°F) Test

An increase in plasticity of the test material at this temperature almost completely eliminated the feed lip breakage that occurred at -65°F; however, this flexibility (plasticity) contributed to the separation of the floor plate from the magazine body during the drop test. The FF type malfunctions were not charged against performance of the test magazine since the malfunctions had previously been charged to a design deficiency (paragraphs 1.4.2 and 2.1). Excluding all malfunctions created by design and material defects, there were seven chargeable malfunctions with the test magazines.

A total of six malfunctions occurred with the control magazines. Three of these magazines had one malfunction each which was attributed to drop-test damage. This damage was repaired by reshaping the feed lips.

1.4.4 Function and Durability Test

Functioning performance of the test and control magazines was excellent. During the firing of 20,000 rounds of ammunition from each type, only two stoppages with the test and six with the control magazines occurred.

This was the first subtest in which the redesigned follower was used in the test magazine. The new follower eliminated the premature release of the last round in the magazine. Unfortunately this change created another problem. During reloading of the magazines the 10-round charger and magazine filler were used. The rectangular profile of the new follower (Figure 2.2-6) can cause incorrect positioning of the first two rounds stripped from the first clip. These rounds are stacked one on top of the other, which limits the magazine capacity to 19 rounds. This causes a feeding failure (double feed) if not corrected prior to firing. Malfunctions caused by incorrect loading were not experienced, only because of the careful loading procedures used.

1.4.5 Static Dust Test

The test magazines were divided into two groups of ten; one group with the original follower (round cartridge profile) and the other with the redesigned follower (rectangular cartridge profile). Twenty control magazines were used. The original test magazine design had a total of eight malfunctions of which 50% occurred in attempting to fire the first round. A significant increase in stoppages was recorded for the magazines when the redesigned follower was used. A total of 28 malfunctions occurred with only 9% being first-round types. Six out of these ten magazines ceased to function within the first five rounds fired. Sixty-four per cent of the 14 stoppages which occurred with the control magazines were first round malfunctions.

1.4.6 Dynamic Dust Test

Testing was conducted with 21 redesigned test and an equal quantity of control magazines. Results of the first phase (magazines enclosed in plastic bags) indicate that test magazines do not degrade weapon performance. In the second phase (magazines without protective covering) the test magazine became susceptible to the same cessation of function experienced in the static dust test (paragraph 2.6).

1.4.7 Sand Test

This test, conducted with 20 redesigned test and 20 control magazines, reconfirms the inadequacy of the test item design. Due to the amount of bearing surface between the inside of the magazine body and its contact with the follower, follower spring, and 20 rounds of ammunition, the sand granules prevented the ammunition from rising in the magazine as the top round was removed. This difficulty was not experienced with the control magazines because of the point-contact design (reduced bearing area) which suspends the follower, follower spring, and cartridge stack within the magazine body.

1.4.8 Mud Test

Results of this subtest, conducted with 20 redesigned test and 20 control magazines, indicate that performance of both magazine types is not entirely predictable, and depends on distribution of the mud within the magazine and around the ammunition. It is apparent, however, from the data accumulated, that the test magazine requires less force than does the control magazine for stripping the first round from the magazine, and if properly redesigned may improve functioning performance in this environment.

1.4.9 Water Immersion Test

This test was a dual-purpose evaluation. The 20 magazines of each type used in the static dust test were subjected to field-type cleaning while being immersed in water. Based on the results of test functioning, it was determined that the magazines are not adversely affected by short duration immersion in water and are easily maintained.

1.4.10 Solvents and Lubricants Compatibility Test

No deleterious effects were created by application of various solvents and lubricants and the insecticide employed.

1.4.11 Displacement Time Study

This test was conducted in a "clean" environment. The results indicate that performance of the redesigned test magazine under this condition is equal to and probably better than the standard magazine. This determination excludes the reloading problem caused by the rectangular cartridge profile configuration of the modified follower and the influence that adverse conditions environments have upon magazine performance.

1.5 CONCLUSIONS

It is concluded that:

a. The test magazine functions reliably when not subjected to adverse conditions and extreme temperature environments (ref pars. 1.4.4, 1.4.11, and 2.5.4).

b. In order to improve operational reliability in adverse conditions environments, a change in the follower and magazine body configurations of the test magazine is required (ref pars. 1.4.5, 1.4.6 (phase 2), 1.4.7, 1.4.8, 2.6.4, 2.7.4, 2.8.4, and 2.9.4).

c. Floor plate retention of the test magazines must be improved to prevent separation from the magazine body during rough handling (ref par. 1.4.4b and Table 2.4-I).

d. The test magazine material durability must be brought up to the equivalent of that of the previous test item (ref par. 2.3.4).

e. Redesign of the test magazine follower is required to prevent the possibility of improper loading when a magazine filler and chargers (clips) are used (ref pars. 1.4.4 and 2.5.4).

f. The magazine filler positioning grooves are not compatible with the magazine filler which is supplied with the ammunition (ref par. 1.4.1c).

g. Over-all performance of the test magazine approaches, but does not equal, that of the control (standard) magazine.

1.6 RECOMMENDATIONS

It is recommended that:

a. Development of the plastic magazine be continued as follows:

   1) A round cartridge profile be used on the test magazine follower.

   2) The test magazine body be modified to reduce the total surface area which contacts the follower, cartridges, and follower spring. The shape of the test follower be changed to be compatible with the magazine body redesign.

   3) The groove in the magazine body which located the position of the magazine filler be changed to reduce the amount of force required to attach and remove the filler during reloading.

   4) The floor plate be redesigned to improve the latching characteristics and thereby insure retention under all environments and rough handling conditions.

   5) All proposed changes to the M16A1 rifle be reviewed to insure continued compatibility of the magazine and weapon (paragraph 6c of Reference 4).

b. The above recommendations be incorporated in the magazine design prior to any issuance of the test magazines for Southeast Asia (SEA) evaluation.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

A test plan outline (Reference 7) was furnished by USALWL as a guide to testing. A series of changes to this outline were verbally coordinated between Materiel Test Directorate (MTD) and USALWL at the direction of USATECOM (Reference 6). The final plan of test is reflected in the methods paragraphs of this section.

A design change was made in the test magazine follower which eliminated premature release of the last round from the magazine. Although this condition was detected during the initial inspection, implementation of the change could not be effected until after completion of the extreme-temperature tests. These tests were not refired with the redesigned-follower magazines since performance in adverse conditions tests with these magazines indicated that other changes were necessary. The primary change required is a reduction of the bearing surfaces inside of the magazine body where the follower, follower spring, and 20 cartridges are in contact. This change can be accomplished by inclusion of radial-form ribs, similar to those of the control magazine, and a change in follower profile to obtain minimum bearing surface without increaseing tilt (rotation about the longitudinal axis). This tilt contributes to premature release of the last round.

Listed in Table 2.1-I are the malfunctions encountered with the test and control magazines. The legend relates to all subtests in this report. Figure 2.1-1 shows the peculiar type of double feed malfunctions.

Table 2.1-I. Legend of Malfunctions

Malfunction	Description
FS1	Failure to strip first round from a fully loaded magazine.
STUB-1	Bullet méplat of first round from magazine contacts receiver below feed ramp of barrel extension.
FS	Failure to strip other than first round from a magazine.
BOB	Bolt override of base of top round in magazine.
FBR	Failure of bolt to remain rearward after last round is fired.
FF	Failure of magazine to feed a cartridge into proper position to be stripped from the feed lips.
DF	Double feed (Figure 2.1-1).

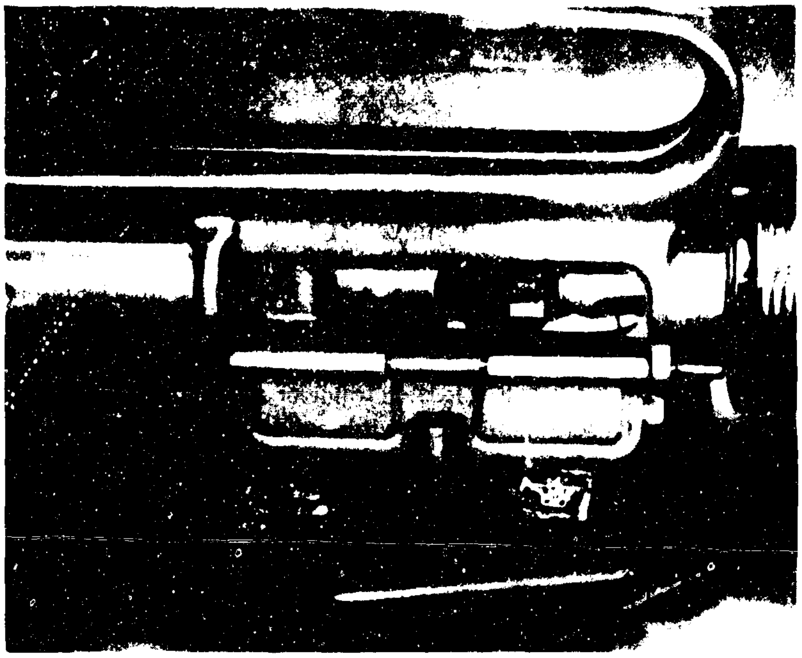


Figure 2.1-1: Right Side View of M16A1 Rifle Showing the Peculiar Type of DF Malfunction Which Occurred during This Test.

2.2 INITIAL INSPECTION

2.2.1 Objective

The objective was to determine the characteristics and condition of the test and support materiel prior to conducting the extreme temperature, adverse conditions, and reliability test phases.

2.2.2 Criteria

Criteria are as follows:

a. The component parts of the test magazines must be free of design, material, and manufacturing defects that would impair reliable functioning and durability.

b. The assembled magazine must be capable of containing a maximum of 20 cartridges when fully loaded.

c. The magazine must possess the capability of being loaded by use of 10-round chargers.

2.2.3 Method

All test and control magazines were visually inspected for manufacturing and material defects. Radiographic pictures (X ray) were obtained of all test magazines which were subjected to drop tests. Physical measurements were taken, as required, to determine the degree of manufacturing uniformity, dimensional conformity to the specification drawings, and compatibility with the M16A1 rifle.

Weapon measurements were taken, as required, to determine weapon serviceability. Each weapon was function-fired with test and control magazines in accordance with the schedule given in Table 2.2-I to determine if any design defects, previously not discovered, were present. The weapons were cooled after trials 2, 4, and 5. The cyclic rate of each 20-round burst and function performance data for all firing were recorded.

Table 2.2-I. Inspection Test Firing Sequence

Trial No.	Firing Mount Type[a]	Magazine Type	Mode of Fire
1	QA	Control	3- to 5-round burst
2	QA	Control	20-round burst
3	QA	Test	3- to 5-round burst
4	QA	Test	20-round burst
5	Benchrest	Test	20-round burst

[a]The quality assurance (QA) mount was the standard item for use in testing M16A1 rifles at the various contractor's plants; benchrest signifies that the weapon was shoulder-supported during firing.

2.2.4 Results

The test and control magazines were uniformly manufactured, although some dimensional specifications were not met. Individual measurements are given in Appendix I. Figures 2.2-1 through 2.2-6 depict the test and control magazines and components thereof. Radiographs of the test magazine components show that variances in material distribution and nonuniform shrinkage caused irregularities in configuration of the floor plate latch detent (Figures 2.2-7 and 2.2-8).

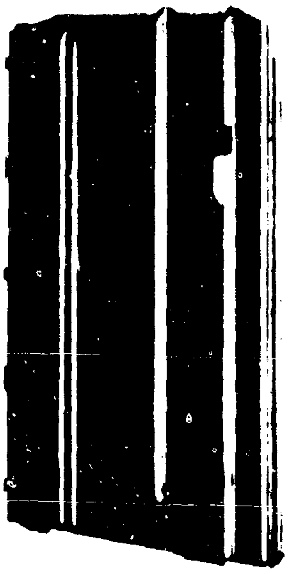


Figure 2.2-1: Left Side View of 20-Round Aluminum (Control) Magazine.

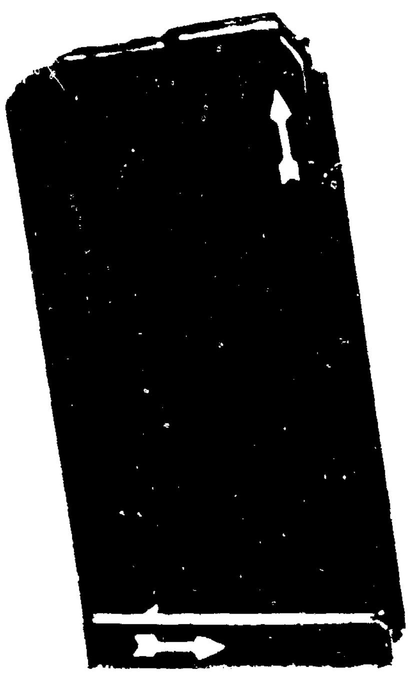


Figure 2.2-2: Second Engineer Design Test (EDT) Magazine (Type 1A) Showing Left Side View. Note the Absense of Vertical Groove at Top Rear of Magazine Which Facilitates Attachment of Magazine Filler, and the Difference of the Base Configuration to That of Figure 2.2-4.

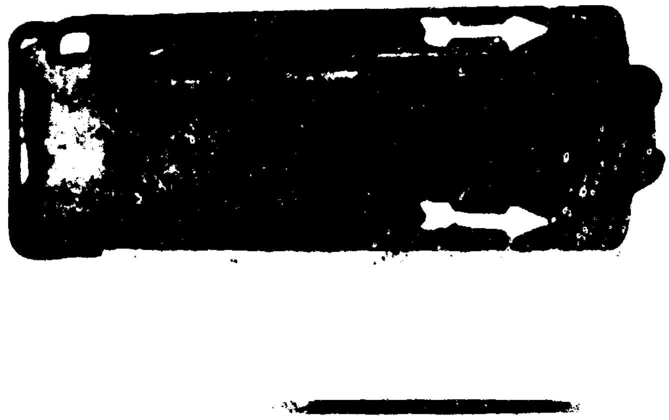


Figure 2.2-3: Top View of the Test Magazine As Molded Prior to Removal (by Sawing) of the Rear of the Feed Lips As Illustrated in Figure 2.2-4.

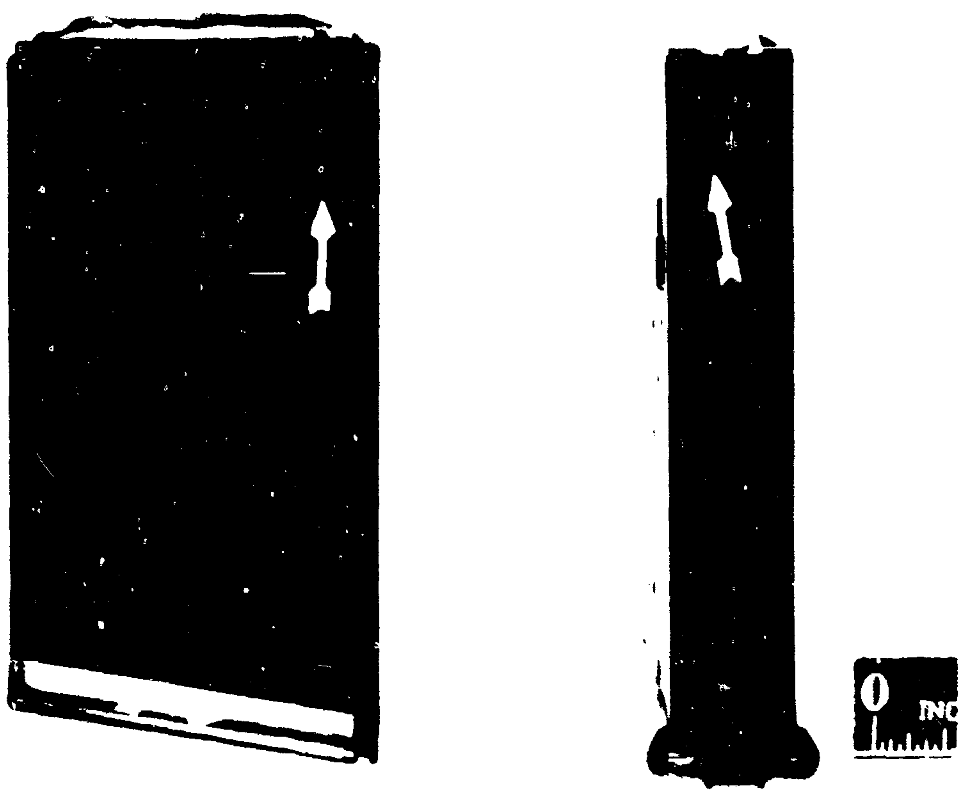


Figure 2.2-4: LEFT: Side View Showing Design Changes of Third EDT Magazine (Type 1B). RIGHT: Rear View of Same Magazine Displaying Die Crack Mark.

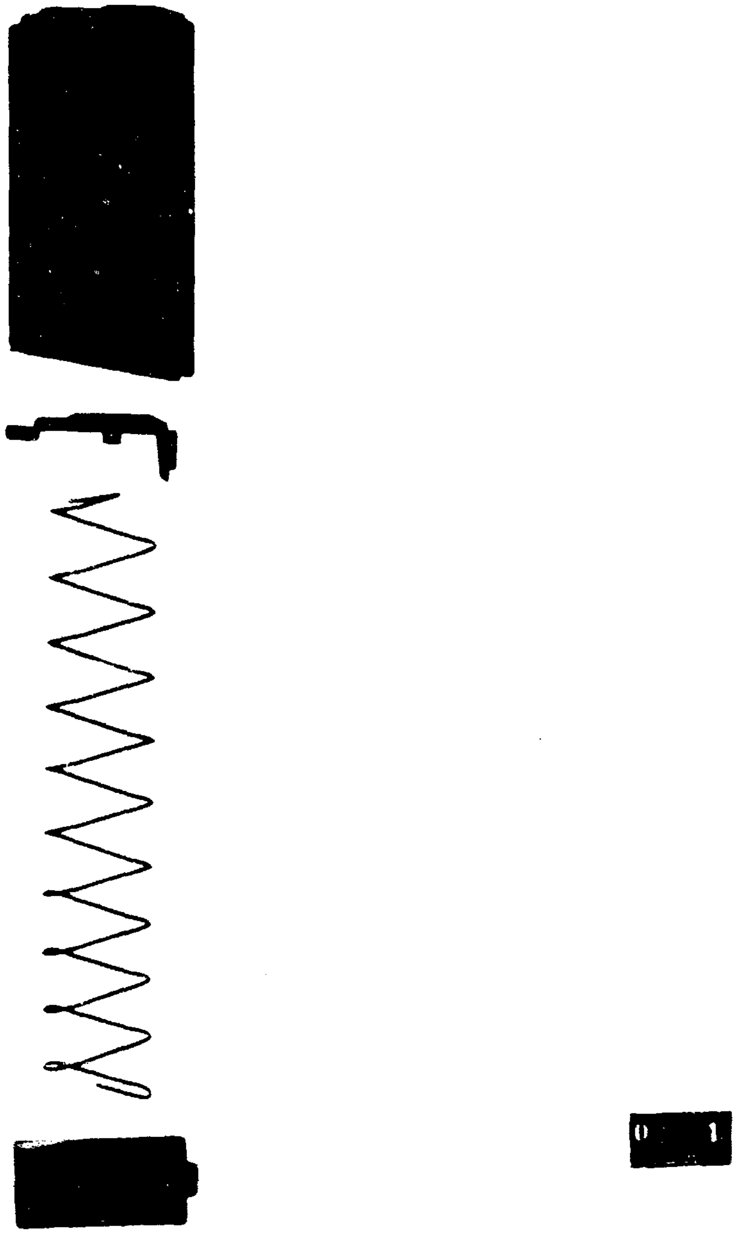


Figure 2.2-5: Disassembled View of Test Magazine (Type 1B) Showing (TOP to BOTTOM) the Magazine Body, Follower, Follower Spring, and Floor Plate.

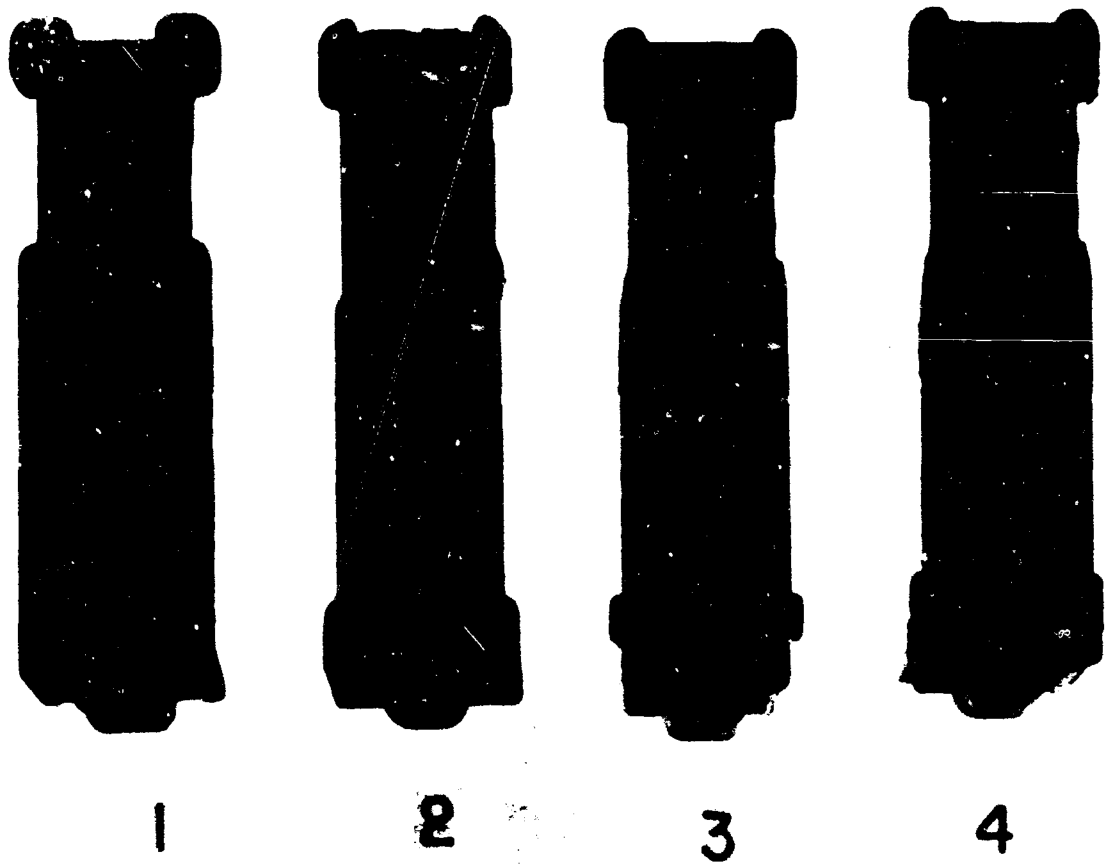


Figure 2.2-6: Comparison of Magazine Follower Designs: 1. Control Magazine. 2. Second EDT (Type 1A) Magazine. 3. Third EDT (Type 1B) First Design. 4.Third EDT (Type 1B) Second Design. (Nos. 2, 3, and 4 are Test Magazines.)

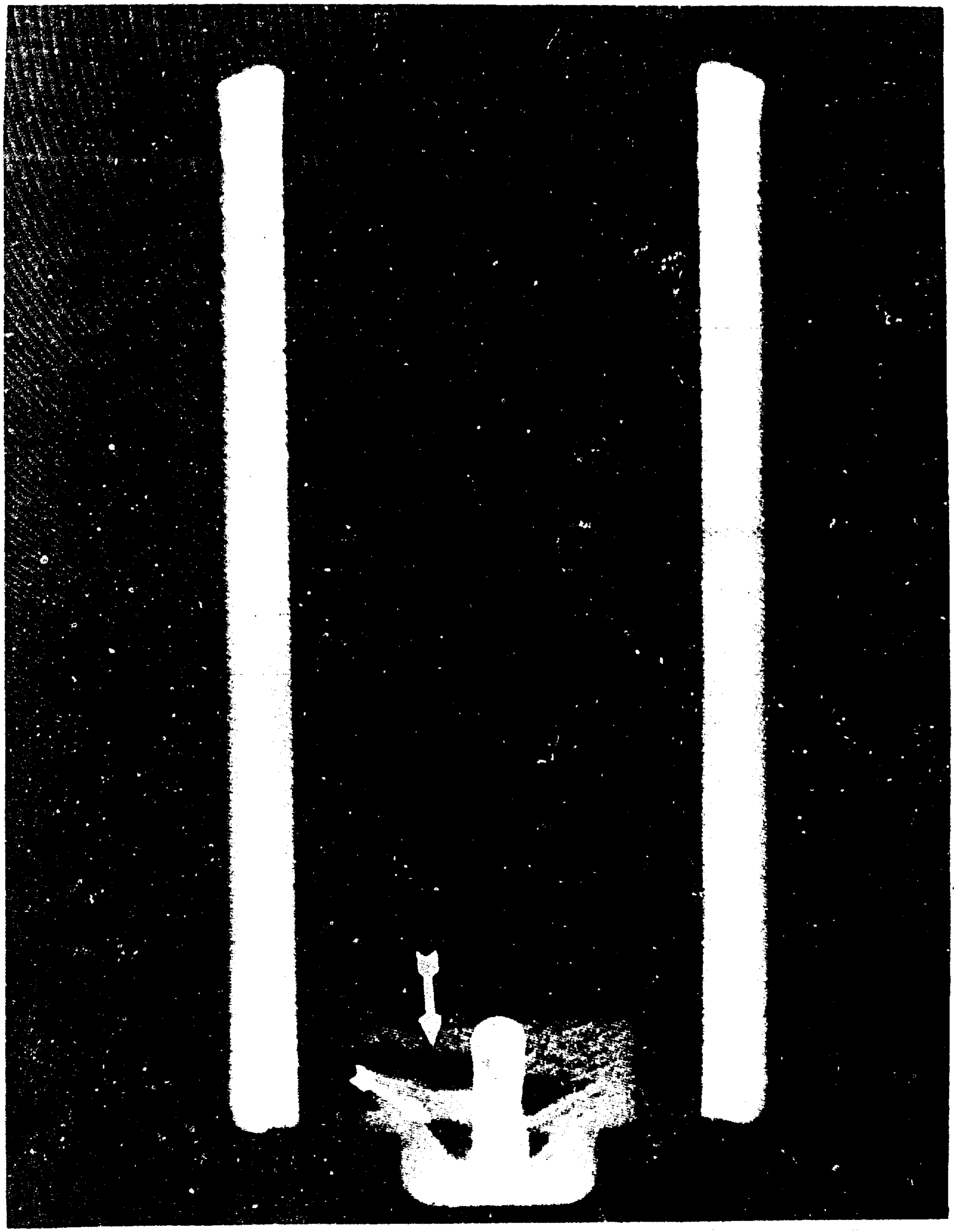


Figure 2.2-7: Radiograph (X Ray) of the Floor Plate from Test Magazine No. 168 Showing the Irregularities of Material Distribution and Flow Pattern.

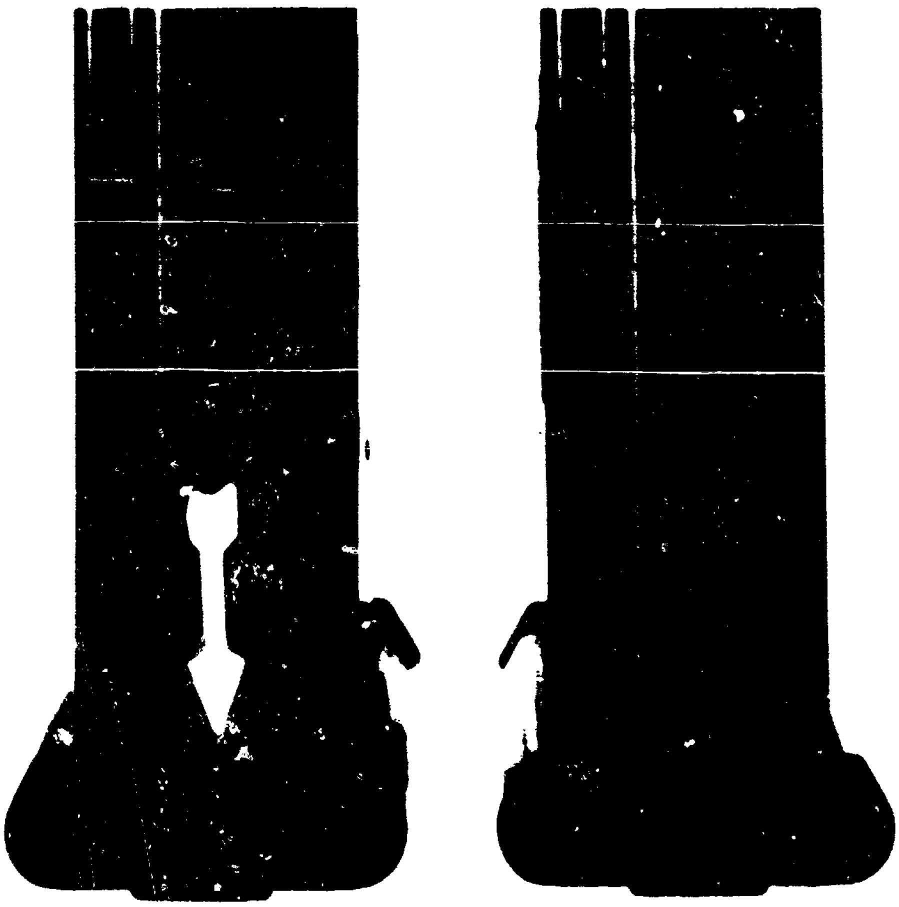


Figure 2.2-8: Rear View of the Test Magazine No. 168 Showing Irregularities of Floor Plate Latch Detent (LEFT) and a Normal Magazine (RIGHT) for Comparison.

Weights of the magazines are given in Table 2.2-II and weapon measurements in Table 2.2-III. The average cyclic rate of fire for the 15 weapons using the control magazine with the weapons fired from the QA test stand was 800 rds/min. The test magazines evaluated under the same conditions gave a 786 rds/min rate. A decrease of 22 rds/min was experienced when the weapons and test magazines were fired from the shoulder. This reduction in rate is considered normal and is related to shoulder-firing conditions.

Table 2.2-II. Component Composition and Weight of Test and Control Magazines

Magazine Type	Sample No.	Floor Plate	Weight, lb				
			Follower		Body	Spring	Total[a]
			Original	Redesign			
Test[b]	1	0.02	0.01	0.01	0.11	0.03	0.17
	2	.02	.01	.01	.11	.03	.17
	3	.02	.01	.01	.11	.03	.17
	4	.02	.01	.01	.11	.03	.17
	5	.02	.01	.01	.11	.03	.17
	6	.02	.01	.01	.11	.03	.17
	7	.02	.01	.01	.11	.03	.17
	8	.02	.01	.01	.11	.03	.17
	9	.02	.01	.01	.11	.03	.17
	10	.02	.01	.01	.11	.03	.17
Average		0.02	0.01	0.01	0.11	0.03	0.17
Control[c]	1	0.01	0.02	-	0.12	0.03	0.18
	2	.01	.02	-	.12	.03	.18
	3	.01	.02	-	.12	.03	.18
	4	.01	.02	-	.12	.03	.18
	5	.01	.02	-	.12	.03	.18
	6	.01	.02	-	.12	.03	.18
	7	.01	.02	-	.12	.03	.18
	8	.01	.02	-	.12	.03	.18
	9	.01	.02	-	.12	.03	.18
	10	.01	.02	-	.12	.03	.18
Average		0.01	0.02	-	0.12	0.03	0.18

[a]Only one follower (original or redesign) considered.

[b]All plastic components are made of nylon, type 6-10, with 50% fiber glass reinforcement. Follower spring material is carbon steel per specification QQ-W-470 with protective finish 3.3.1 of MIL-STD-171.

[c]Magazine body is made of aluminum alloy 6061-0 strip per specification QQ-A-250/11 with magnesium content at 1.0/1.2%. T6 condition after forming and welding. Minimum Brinnell 80 (10-mm ball - 500-kg load); finish MIL-A-8625, type 3; class 1, 0.0010 ± 0.0002 inch. Solid film lubricant electrofilm 99-A at 0.0002/0.0004-inch thickness. Follower material is die casting alloy A-380, per specification QQ-A-591. Floor plate material is 6061-T4 aluminum strip per specification QQ-A-225/8; etched finish 7.2.2 of MIL-STD-171, dyed black. Follower spring material is carbon steel per specification QQ-W-470, with finish 3.3.1 of MIL-STD-171.

Table 2.2 III. Physical Characteristics of Weapons

Weapon Type: M16A1 rifle.

Weapon Nos.		Physical Measurements, in.	
APG Assigned	Serial	Head Space	Firing Pin Protrusion
1	1089798	1.4656	0.034
2	1090627	1.4646	.033
3	1090791	1.4646	.030
4	1091331	1.4646	.034
5	1091713	1.4666	.032
6	1092509	1.4646	.033
7	1094769	1.4656	.031
8	1094915	1.4646	.032
9	1096034	1.4656	.034
10	1096779	1.4646	.031
11	1096890	1.4646	.033
12	1097064	1.4646	.031
13	1097430	1.4656	.034
14	1100035	1.4656	.033
15	1101003	1.4646	.034
Average		1.4650	0.033
Maximum		1.4666	.034
Minimum		1.4646	.030
Extreme variation		0.0020	.004

During the inspection firing, no malfunctions occurred with the control magazines. Six FF's and four FBR's occurred with the test magazines. Firing was from the QA test stand. An additional five FF-type stoppages occurred when the rifles were shoulder fired. In all instances the FF malfunctions were last-round occurrences where the loaded cartridge was incorrectly released from the magazine feed-lips prior to entry into the weapon chamber. The USALWL was notified about this design deficiency. They requested that the extreme-temperature tests be conducted to determine material durability and stated that a component redesign would be immediately undertaken to correct the problem. As a result, a new follower configuration was manufactured and ready for testing at the start of ambient-temperature function and durability and adverse conditions phases (Figure 2.2-9).

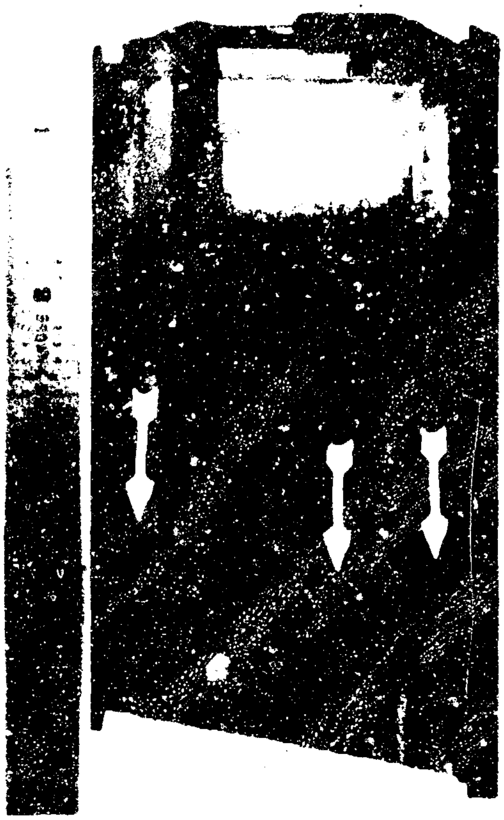


Figure 2.2-9: Cutaway View (Left Side Removed) of the Interior Configuration of the Test Magazine with Redesigned Follower Positioned toward the Bottom of the Magazine. The Three Arrows Indicate the Contact Surfaces of the Follower and Magazine Body Which Causes Seizure between These Components and Prevents Upward Movement of the Ammunition Stack during Firing in Adverse Conditions.

2.2.5 Analysis

The M16A1 rifles were found to be in satisfactory condition. The control magazines, having previously been purchased and accepted by the US Government, are considered representative of production samples and therefore satisfactory for test purposes although some dimensions exceeded tolerance allowances.

A change in configuration of the test magazine is required to eliminate the problem on nonretention of the last round. Gating of the floor plate die should be changed to insure complete formation of the lock detent. As a result of these design problems, the test magazine does not completely satisfy the test criteria.

2.3 EXTREME LOW TEMPERATURE TEST (65°F)

2.3.1 Objective

The objective was to determine the relative material durability and functional reliability of the test and control magazines.

2.3.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.3.3 Method

Prior to testing, each rifle was cleaned with PS 661-B solvent and lubricated with MIL-L-14107 oil. Maintenance on the weapons during firing was performed only if unsatisfactory weapon functioning, not associated with magazine performance, was evidenced.

Five weapons, 50 each new test and control magazines, and 10,000 rounds of M193 ball ammunition (packed in 10-round charger clips) were temperature-conditioned at -65°F in accordance with Reference 1. Prior to test functioning, a drop test was conducted in the following manner:

a. From a height of 5 feet, 25 fully-loaded magazines of each type were dropped twice onto a flat concrete surface (first on top forward and then top rearward area of the magazines).

b. The remaining 25 test and control magazines were dropped (fully loaded) to impact on the base, in a base-forward and a base-rearward impact attitude.

c. The magazines were visually inspected after each drop trial, and a record was made of any resultant damage.

d. After completion of test firing, photographs were made of material drop-test damage to the magazines.

The firing exercise was conducted in accordance with Table I-I, and the cyclic rate of fire for all 20-round automatic bursts and malfunction data for all firing were recorded.

A supplementary drop test was conducted with 20 samples each of the test magazines used in the second EDT (type 1A) and this EDT (third)(type 1B). Each type was divided into groups of ten magazines and dropped in accordance with the procedures outlined above, except that the type 1A magazines were dropped onto concrete and 1B type onto 3/8-inch plywood.

2.3.4 Results

Data from the prefiring drop tests are given in Tables 2.3-I and 2.3-II. Function performance data are tabulated in Table 2.3-III. Figures 2.3-1 through 2.3-3 show damage to the magazines caused by the 5-foot drop test. Cyclic rate of fire data are given in Table I-IV.

Table 2.3-I. Five-Foot Drop Durability of Third EDT Magazines; Low-Temperature Test (-65°F)

		No. Malfunctions		Drop-Caused Defects							No. Magazines
			Without Drop-Caused	Feed-Lip Damage				Ejected			Usable
Magazine Type	Drop Orientation	No.	Dropped[a]	Defects[b]	Right	Left	Both	Floor Plate	No. Mags	No. Rds	Total Defects[c]	After Drop Test
Test (1B)	Base	1	25	2	4			14	17	21	35	[d] 4
	Feed lips		25	1	8	2	9		24	34	43	
	Base	2	25	4	5	1		1	20	29	27	
	Feed lips		25	4	2	3	1		21	29	27	
Control	Base	1	25	6				16	3	6	19	[e] 1
	Feed lips		25	1	4	4			24	29	32	
	Base	2	25	11				2	13	20	15	
	Feed lips		25	2	12	1	1		17	17	31	

[a] A total of 50 magazines per type were drop-tested twice; 25 on the feed lips and 25 on the floor plate.

[b] No test and only two control magazines completed both drop trials without incidence of drop-caused defects.

[c] Number of rounds ejected from individual magazines are not included in these totals.

[d] Broken right feed lips caused release of ammunition.

[e] Top spot weld at rear of magazine was broken, causing expansion of feed lips and release of ammunition.

Table 2.3-II. Comparative[a] 5-Foot Drop Durability of Second and Third EDT Magazines; Low-Temperature Test (-65°F)

Test Magazine Types[b]	Drop Orientation	No.	Dropped[c]	Without Drop-Caused Defects[d]	Drop-Caused Defects: Feed-Lip Damage Right	Left	Both	Floor Plate	Ejected No. Mags	Ejected No. Rds	Total Defects[e]
1A	Base	1	10	3	1			1	5	6	7
	Feed lips		10	0	5			1	10	15	16
	Base	2	10	1	2				5	6	7
	Feed lips		10	3			1		6	6	7
1B	Base	1	10	3					7	8	7
	Feed lips		10	0	3	4	3		10	12	20
	Base	2	10	6					4	4	4
	Feed lips		10	0					8	8	8

[a] Type 1A magazines were dropped onto a flat concrete surface and type 1B onto 3/8-inch plywood.

[b] Type 1A used in the second EDT and type 1B in the present (third) EDT.

[c] A total of 20 magazines per type were used ; ten were dropped twice on feed lips, the remainder on the base.

[d] One type 1A and two type 1B magazines completed the drop tests without defects.

[e] Number of rounds ejected from individual magazines are not included in these totals.

Table 2.3-III. Function Performance Characteristics of Third EDT Magazines; Low-Temperature Test (-65°F)

Magazine Type	No. Mags Tested	No. Rds Fired	Five Foot Drop Orientation	No. Mags Without Malfunct	Load No.	Tight Fits of Magazines in Weapon during[a]		No. of Malfunctions by Type			Total Malfunct
						Insertion	Removal	FF-20	DF	FBR	
Test (1B)	24	480	Base	11	1	0	0	11	0	0	[b]0
	22	440	Feed lips	13	1	0	0	6	0	0	[b]0
Control	25	500	Base	17	1	3	2	0	3	1	4
	24	480	Feed lips	20	1	1	1	0	1	0	1

[a]These defects caused by bulging of themagazine body during drop testing. They did not contribute to magazine malfunctions.
[b]Only DF and FBR malfunctions were charged to the magazine operation. The FF-20 malfunctions were charged to inadequate magazine design.

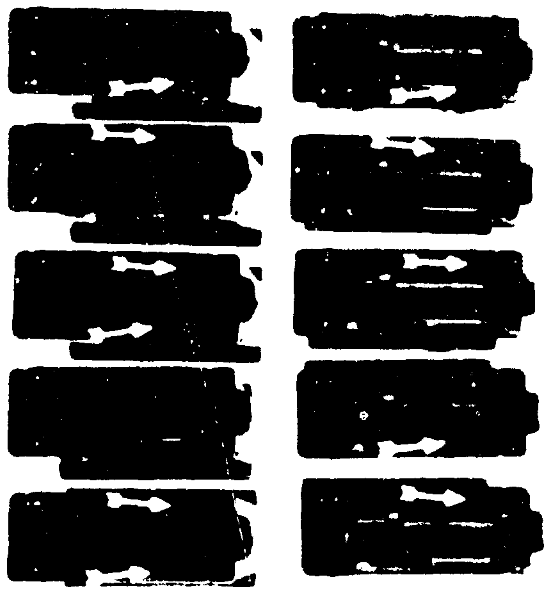


Figure 2.3-1: Material Damage to Third EDT (Type 1B) Magazines Caused by Drop Test at -65°F onto Concrete Surface. Note Feed-Lip Breakage.

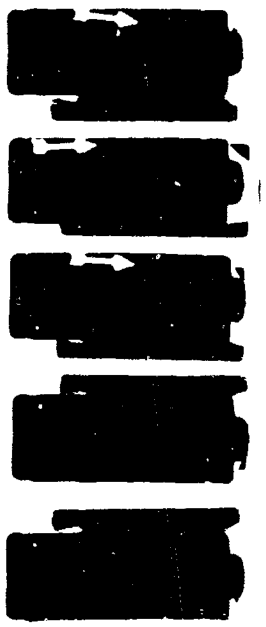


Figure 2.3-2: Material Damage to Third EDT (Type 1B) Magazines Caused by Drop Test at -65°F onto 3/8-Inch Plywood. Note Damage Similar to Figure 2.3-1.

Figure 2.3-3: Material Damage to Second EDT Magazines (Type 1A) Caused by Drop Test at 65°F onto Concrete Surface. Note Greatly Reduced Damage to Feed-Lip Area, when Compared with Type 1B Magazines.

2.3.5 Analysis

The change in drop test impact surface from 3/8-in plywood to concrete (necessary to conform to current test procedures) increased the severity of the material damage to both test and control magazines. However, based on the results of the supplementary drop test, it is apparent that there has been a definite degradation of material strength with the latest test magazine configuration (Figures 2.3-1 through 2.3-3).

Provided that material failure does not occur with the test magazine, its capability to resist permanent deformation, caused by drop impact, is better than the standard control magazine (see Figure 2.4-1 for control magazine deformation). Because of the present inability of the test magazine to avoid breakage of the feed lips, the test criterion has not been satisfied.

2.4 EXTREME HIGH TEMPERATURE TEST (+155°F)

2.4.1 Objective

The objective was to determine the relative material durability and functional reliability of the test and control magazines.

2.4.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.4.3 Method

Prior to testing, each rifle was cleaned with PS 661-B solvent and lubricated with MIL-L-46000A semifluid oil. Maintenance on the weapons during firing was performed only if unsatisfactory weapon functioning, not associated with magazine performance, was evidenced.

Five weapons, 50 each new test and control magazines, and 10,000 rounds of M193 ball ammunition (packed in 10-round charger clips) were temperature-conditioned at +155°F in accordance with Reference 1. Prior to test functioning, a drop test was conducted in the following manner:

a. From a height of 5 feet, 25 fully-loaded magazines of each type were dropped twice (first on top forward and then top rearward area of the magazines) onto a flat concrete surface.

b. The remaining 25 test and control magazines were dropped to impact on the base, in a base forward and base rearward impact attitude.

c. The magazines were visually inspected after each drop trial, and a record was made of any resultant damage.

The firing exercise was conducted in accordance with Table I-II and the cyclic rate of fire for all 20 round automatic bursts and malfunction data for all firing were recorded.

,.4 Results

Data relating to the 5-foot drop test and function firing performance are given in Tables 2.4-I and 2.4-II. Figures 2.4-1 and 2.4-2 show the drop-test damage sustained by the control and test magazines. Permanent deformation of the control magazine feed lips and swelling of the magazine body, while severe, did not impede use in most instances and was repairable in those instances where malfunctions resulted. Test magazine damage was negligible.

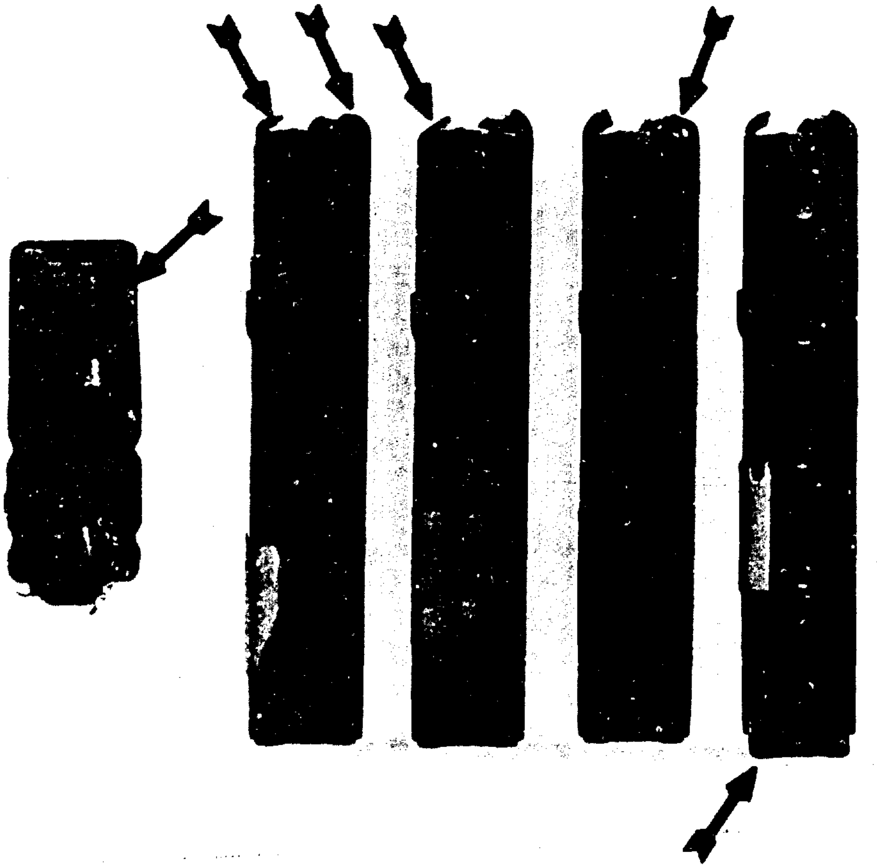


Figure 2.4-1: Five-Foot Drop Test Damage to Control Magazines at +155°F. LEFT to RIGHT: Top Forward Portion of Right Feed-Lip Bent Inward; Three Magazines with Deformed Rear Portion of Feed-Lip; and One Magazine with Floor Plate Damage. Similar Results Occurred at -65°F.

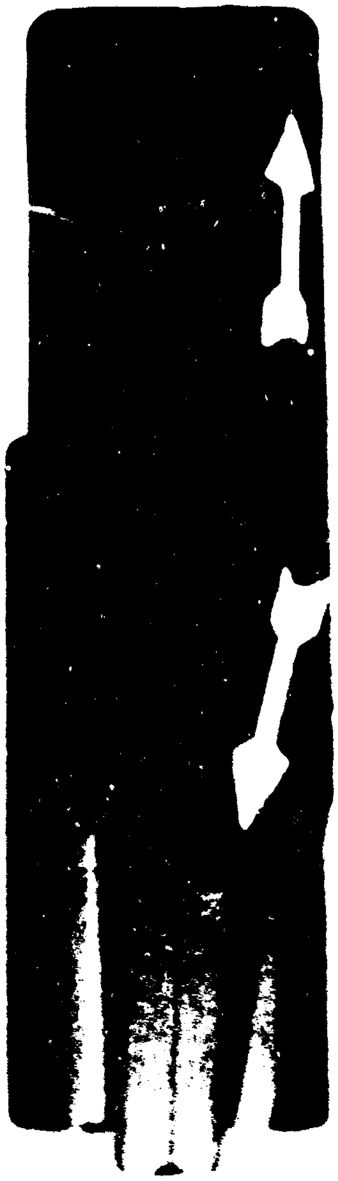


Figure 2.4-2: Five-Foot Drop Test. Representative Damage to Test Magazines at +155°F. Slight Deformation of Magazine Body (Arrows) Is the Normal Extent of Damage Occurring on These Magazines.

Table 2.4-1. Five-Foot Drop Durability of Third EDT Magazines; High-Temperature Test (+155°F)

Magazine Type	Drop Orientation	No.	No. Mags Dropped	No. Mags Without Drop-Caused Defects	Drop-Caused Defects: Feed-Lip Damage: Right	Feed-Lip Damage: Left	Feed-Lip Damage: Both	Floor Plate	Ejected Rounds: No. Mags	Ejected Rounds: No. Rds	Total Defects[a]
Test (1B)	Base	1	25	0	0	0	0	20	24	[b]126	44
	Feed lips		25	0	0	0	0	7	25	72	32
	Base	2	25	0	1	0	0	12	25	45	38
	Feed lips		25	0	0	0	0	5	21	53	26
Control	Base	1	25	0	0	0	0	19	7	12	26
	Feed lips		25	0	6	8	1	0	20	29	45
	Base	2	25	0	0	0	0	5	5	7	10
	Feed lips		25	0	7	2	2	0	14	15	25

[a]Number of rounds ejected from individual magazines are not included in these totals.
[b]Six magazines ejected a total of 93 rounds due to complete release of the floor plate from the body of the magazine.

Table 2.4-II. High-Temperature (+155°F) Function Performance Data

Magazine Type	Average Cyclic Rate, rds/min	APG Weapon No.	No. of Malfunctions: Weapon Mode of Fire[a] FA	SA	B	Total
Test	863	11	4	4	10	18
Control	854		0	1	[b] 1	2
Test	941	12	0	4	5	9
Control	931		0	1	0	1
Test	914	13	2	5	8	15
Control	900		0	1	0	[c] 1
Test	912	14	1	2	8	11
Control	902		0	0	1	1
Test	924	15	5	3	7	15
Control	922		0	0	1	[c] 1
Average		Total				
Test	911	Test	12	15	38	[d] 68
Control	903	Control	0	3	3	[e] 6

[a] FA = Fully automatic, SA = Semiautomatic, and B = Short automatic bursts.

[b] This malfunction was a first-round stub which can occur in any mode of fire.

[c] This malfunction was a bolt override of the round which damaged the cartridge case. It was caused by drop-test damage to the magazine feed lips. This damage was subsequently repaired and no further malfunctions occurred during the remaining four trials.

[d] Two magazines developed material failure which caused three malfunctions. The magazines could not be repaired and were withdrawn from test.

2.4.5 Analysis

Eighty five per cent of the malfunctions that occurred with the test magazines were attributable to design deficiencies (paragraph 2.1) With the exception of two instances of feed lip breakage, the test magazine structure was not affected by the 5 foot drop test (Figure 2.4-2). Damage to the control magazines which adversely affect functioning performance is correctable (Table 2.4-II, footnote b). As a result of the design deficiency in the test magazine, the test criterion has not been satisfied; however, with exclusion of this problem, the test and control magazine performance is equal.

2.5 FUNCTION AND DURABILITY TEST

2.5.1 Objective

The objective was to determine the relative functional reliability and material durability of the test and control magazines.

2.5.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.5.3 Method

Prior to testing, each rifle was cleaned with PS 661-B solvent and lubricated with MIL-L-46000A semifluid oil. Maintenance on the weapons and magazines during the firing exercise was performed only to the extent of ensuring proper mechanical operation.

The firing sequence was conducted in accordance with the schedule given in Table 1-III, and the malfunction and cyclic rate of fire data were recorded.

2.5.4 Results

Table 2.5-I gives the function and durability test data. Appendix I contains the individual round data.

Table 2.5-1. Function and Durability Test Data

Type	Load No.	No. Magazines Tested	Total No. Rds Fired	Avg Cyclic Rate, rds/min	No. Magazines with Malfunctions	Total No. Malfunctions
Test	1 to 5	100	10000	831	2	2
	6 to 50	[a] 10	10000	842	0	0
	1 to 50	-	20000	836	2	2
Control	1 to 5	100	10000	825	2	2
	6 to 50	[a] 10	10000	844	3	4
	1 to 50	-	20000	834	5	6

[a]Ten magazines selected from the original 100-magazine sample.

This was the first subtest which utilized the redesigned follower. An immediate improvement in function performance was evidenced; however, the new design induced a loading problem into the system. When the magazines were loaded by charger clips, the retangular cartridge dummy on the follower caused the first two rounds in the magazine to stack on the same side. This reduced the magazine capacity to 19 rounds and additionally would cause a double feed of the last two rounds from the magazine unless corrected prior to firing. Data pertaining to individual cyclic rates of fire are given in Tables I-VII through I-IX.

2.5.5 Analysis

Function performance of the test and control magazines was excellent; however, because the test magazine is capable of being incorrectly loaded when using charger clips, the test item cannot be considered equal to the control magazine.

2.6 DUST TEST (STATIC)

2.6.1 Objective

The objective was to determine the relative functional reliability of the test and control magazines in a dust environment.

2.6.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.6.3 Method

Twenty magazines of each type were simultaneously conditioned in accordance with the procedures outlined in Reference 1, except that the weapons were not conditioned in the dust. The magazine array was established in conformity with Figure I-2.

Five magazines per weapon were test fired, alternating the mode of fire as follows: burst, automatic (20 rounds), semiautomatic, burst, and semiautomatic. Maintenance was performed on the weapons after each 100 rounds fired.

2.6.4 Results

Functioning performance data are given in Tables 2.6-I and 2.6-II. The malfunction rates per 100 rounds fired and the percentage of first-round malfunctions (FS1) respectively are as follows:

a. Test magazines with round cartridge profile follower - 4.0, 50.0%.

b. Test magazines with rectangular cartridge profile follower - 27.4, 10.7%.

c. Control magazines - 3.5, 64.3%.

These data indicate that a design problem exists with the test magazine; the follower fails to rise, even after repeated attempts to forcibly correct the problem by sharply impacting the magazine on the shooting bench. This failure is caused by excessive bearing surface of the magazine body (sides) contacting the follower and cartridges. The fine dust particles (140 mesh) cause seizure of the moving components.

The variation in functioning performance of both test and control magazines was caused by the magazine position within the dust box; the magazines closest to the dust intake received the greater concentration of the dust. The magazine array in the dust box (Figure I-2) was designed to cover dust distribution on an equal basis for each magazine type.

Table 2.6-I. Malfunction Data for Test Magazines Used in the Static Dust Test

APG Weapon No.	Magazine No.	No. of Malfunctions							Cyclic Rate of Fire, rds/min	No. Rds Fired		
		FS1	FS	FF	BOB	DF	FBR	Total		Before First Malfunction	Before Function Failure	Total
1	321	1		1	1			3		0	1	1
	322	1			1			2	696 (17 rounds)	0	3	3
	323			1				1		3	b-	20
	324			2	1			3		4	-	20
	325							0		-	-	20
a2	326							0		-	-	20
	327	1			1			2	575 (12 rounds)	0	-	20
	328							0		-	-	20
	329							0		-	-	20
	330				1			1		19	-	20
3	331			4	1			5		2	4	4
	332			1	2			3	757 (14 rounds)	4	-	20
	333			3	2			5		2	4	4
	334			2				2		3	5	5
	335	1		2	1			4		0	5	5
a4	336				1			1		19	-	20
	337	1						1	783 (20 rounds)	0	-	20
	338							0		-	-	20
	339	1						1		0	-	20
	340	1			1			2		0	-	20
Total, New follower		3	0	16	9	0	0	28				102
Total, Old follower		4	0	0	4	0	0	8				200

[a]Magazines used with this weapon had the original (old) follower design of round cartridge profile and reduced side bearing surfaces.
[b]No occurrence.

Table 2.6-II. Malfunction Data for Control Magazines Used in the Static Dust Test

APG Weapon No.	Magazine No.	No of Malfunctions FS1	FS	FF	BOB	DF	FBR	Total	Cyclic Rate of Fire, rds/min	No. Rds Fired Before First Malfunction	Before Function Failure	Total
1	321	1						1		0	b.	20
	322	1						1	677 (20 rounds)	0	-	20
	323	1						1		0	-	20
	324							0		-	-	20
	325	1					1	2		0	-	20
2	326							0		-	-	20
	327	1						1	a.	0	-	20
	328	1						1		0	-	20
	329							0		-	-	20
	330							0		-	-	20
3	331					1		1		18	-	20
	332		2					2	636 (17 rounds)	2	-	20
	333					1		1		18	-	20
	334							0		-	-	20
	335	1						1		0	-	20
4	336							0		-	-	20
	337	1						1	775 (20 rounds)	0	-	20
	338	1						1		0	-	20
	339							0		-	-	20
	340							0	-	-	-	20
Total		9	2	0	0	2	1	14				400

[a]Lost.
[b]No occurrence.

2.6.5 Analysis

Cessation of function of the test magazine with the redesigned follower prevents the test criterion from being satisfied. Use of the original follower design did eliminate the problem of function stoppage. Although premature release of the last round in the magazine did not occur, the malfunction rate of the test magazines was still twice that of the control magazine.

2.7 DUST TEST (DYNAMIC)

2.7.1 Objective

The objective was to determine the comparative function performance of the test and control magazines in relation to weapon performance when the system is fired during dust conditioning.

2.7.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.7.3 Method

Three weapons were cleaned with PS 661-B solvent and lubricated with MIL-L-46000A semifluid oil prior to this test and after each magazine type tested. Each rifle was fired 140 rounds while being subjected to a continuous blast of dust in a specially contructed box. The 140-mesh silica flour dust was introduced into the dust box at a rate of 2 pounds per minute and circulated by a blower which was operated at a rate of 60 rpm. The weapons were fired, alternately in 20-round bursts, semiautomatic fire, and 3- to 5-round bursts with the first, fourth, and seventh magazines fired in 20-round bursts. The rate of firing was approximately one magazine every 20 seconds for a total test time duration of 2-½ minutes. The magazines were protected from the dust by use of plastic bags until ready to load into the weapon. Cyclic rates of fire and total firing time were recorded.

If the firings were accomplished without malfunctions which were not readily clearable, the weapons were cooled and the firing cycle was repeated for two more trials (420 rounds, total of three trials). Clean magazines (not maintained) were used.

The weapons were maintained and the above sequence was repeated with the other magazine type (three trials of 140 rounds each).

Two weapons and the test and control magazines were maintained and the testing (total of 420 rounds on each type magazine) was repeated with the protective covers removed from the magazines.

2.7.4 Results

Table 2.7-I gives the data for the dynamic dust test. With the exception of one trial with weapon No. 2 using the control magazine, both magazine types functioned reliably when provided with protective covering. Without the protective covering the test magazine is susceptible to function stoppage as previously detected during the static dust test. The control magazines functioned satisfactorily after first-round stripping was accomplished with the bolt closure assist device.

Table 2.7-I. Dynamic Dust Test Firing Data

Magazine Type	Weapon No.	140-Rd Trial No.	Magazine No.	Cyclic Rates of Fire, rds/min, Trial: First	Second	Third	Total Firing Time, min	No. of Malfunctions, Type: FS1	FF	BOB-20	FFR[a]	FBR	Total
Magazines with Protective Covering													
Test	1	1	361 to 367	813	806	832	3.6						0
		2	368 to 374	775	825	863	2.4						0
		3	375 to 381	786	849	867	2.1						0
Average				791	827	854	2.7						
Control	1	1	361 to 367	820	783	849	2.1	1				1	2
		2	368 to 274	786	845	879	2.0						0
		3	375 to 381	786	865	877	2.1						0
Averag				797	831	868	2.1						
Test	2	1	361 to 367	798	853	900	2.2						0
		2	368 to 374	806	897	893	1.9						0
		3	375 to 381	743	861	900	2.1						0
Average				782	870	898	2.1						
Control	2	1	361 to 367	798	778	783	4.4	2		1	1		4
		2	368 to 374	772	775	[b] -	3.6	4		1	1		6
		3	375 to 381	[b] -	[b] -	[b] -	3.0	5			1		6
Average				-	-	-	3.7						

[a]Possibly caused by failure to lock bolt.
[b]No data recorded.

Table 2.7-I (Cont'd)

Magazine Type	Weapon No.	140-Rd Trial No.	Magazine No.	Cyclic Rates of Fire, rds/min. Trial First	Second	Third	Total Firing Time, min	No. of Malfunctions Type FS1	FF	BOB-20	FFR[a]	FBR	Total
Test	3	1	361 to 367	b -	b -	b -	2.5						0
		2	368 to 374	b -	b -	b -	2.1						0
		3	375 to 381	b -	b -	b -	2.9						0
Average				-	-		2.5						
Control	3	1	361 to 367	891	867	908	2.0						0
		2	368 to 374	794	871	900	1.9						0
		3	375 to 381	825	857	879	1.7						0
Average				837	865	896	1.9						
Magazines without Protective Covering													
Test	1	1	361 to 367	810	808	802	2.8				1		1
		2	368 to 374	746	816	834	2.0						0
		3	375 to 381	753	302	c -	2.9	1	c 1	1			3
Average				770	809	-	2.6						
Control	2	1	361 to 367	842	758	849	2.7	6					6
		2	368 to 374	792	842	863	2.1	7					7
		3	375 to 381	791	834	853	2.0	7					7
Average				808	811	855	2.3						

[c]Only four rounds fired prior to function failure of magazine.

2.7.5 Analysis

The test magazine requires less effort to strip the first round from a fully- loaded magazine than does the control magazine. (Note the difference in total number of FS1-type malfunctions.)

The test magazines must be equipped with dust covers to prevent possible function failure in a dusty environment (see Table 2.7-I phase 1 and Table 2.6-I for comparison).

Provided that protective covering is used on the magazines, the test criterion is satisfied; however if this covering is not present, then the test magazine is susceptible to an increase in malfunctions and possible function stoppage during firing.

2.8 SAND TEST

2.8.1 Objective

The objective was to determine the relative function performance of the test and control magazines after conditioning in a sand environment.

2.8.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.8.3 Method

Four M16A1 rifles were cleaned with PS 661-B solvent and lubricated with MIL-L-46000A semifluid oil. Twenty magazines of each type were tested in the following manner:

a. Each magazine was completely covered with clean, dry silica- core sand.

b. The magazines were removed from the sand, wiped on the outside, inverted and shaken vigorously to remove any accumulation of sand from the interior, and then test functioned.

Five magazines per type per rifle were tested.

2.8.4 Results

Tables 2.8-I and 2.8-II give the results of the sand test. Figure 2.8-1 shows one of the FF malfunctions which occurred with the test magazines. The follower and last cartridge were securely held in position by several small granules of sand. A discussion of this condition and corrective action required is given in paragraph 2.1.

Table 2.8-I. Sand Test Data for Test Magazines

APG Weapon No.[a]	Magazine No.	No. Malfunctions by Type				No. Rds Fired	
		STUB	FS1	FF	BOB	Before First Malfunction	Before Function Stoppage
1	301			4	2	1	3
	302				1	4	4
	303	1		2		3	7
	304				1	1	1
	305			1		2	2
2	306				1	1	b.
	307				1	1	.
	308				2	2	.
	309					.	.
	310				1	1	.
3	311			2		1	3
	312				1	1	1
	313	1		3	1	1	1
	314				1	1	1
	315			1		2	2
4	316			2		1	.
	317			1	1	1	.
	318		1		1	0	.
	319					.	.
	320				1	1	.
Total	20	2	1	16	15		

[a]Weapons 2 and 4 were tested with the first design follower (radial cartridge dummy and reduced side surface bearing).
[b]No occurrence.

Table 2.8-II. Sand Test Data for Control Magazines

APG Weapon No.	Magazine No.[a]	No. Malfunctions, by Type, DF	No. Rds Fired: Before First Malfunction	No. Rds Fired: Before Function Stoppage
1	301		b	
	302	1	18	.
	303		.	.
	304			.
	305		.	.
2	306		.	.
	307		.	.
	308		.	.
	309	1	18	.
	310		.	.
3	311	1	18	.
	312		.	.
	313		.	.
	314		.	.
	315		.	.
4	316		.	
	317		.	.
	318		.	.
	319		.	.
	320		.	.
Total	20	3		

[a]Twenty rounds in each magazine.
[b]No occurrence.

Figure 2.8-1: Top View of Cartridge (Round 20) and F[illegible]ver Jammed in Test Magazine. Note the Granules of Sand Lodged between Side (Left Rear) of Cartridge Case and Magazine.

2.8.5 Analysis

Test magazine function stoppages prevent the test criterion from being satisfied.

2.9 MUD TEST

2.9.1 Objective

The objective was to determine the relative function performance of the test and control magazines after immersion in mud.

2.9.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.9.3 Method

Four M16A1 rifles were cleaned with PS 661-B solvent and lubricated with MIL-L-46000A semifluid oil. Twenty magazines of each type were tested in the following manner:

a. A magazine was immersed in the mud solution (prepared in accordance with Reference 1) and quickly retrieved.

b. The mud was wiped from the magazine exterior, the magazine was inverted and vigorously shaken to expel any mud from the magazine interior, and then immediately test functioned in the weapon.

Five magazines per rifle per type were tested. Weapon maintenance was performed after each group of five magazines tested.

2.9.4 Results

Table 2.9-1 gives the results of the mud test.

Table 2.9-1. Mud Test Data for Test and Control Magazines

Magazine Type	No. Loaded Magazines Tested	No. Magazines without Malfunctions	No. Magazine Malfunctions Type FS1	FS	FF	DF	BOB	FBR	Total
Test	[a]20	8	0	0	6	0	12	0	18
Control	20	9	3	4	4	2	3	2	18

[a]Twenty rounds each magazine.

2.9.5 Analysis

The test magazine malfunctions which occurred indicate that the same design problem observed in the sand and dust test (seizure of the follower and cartridges in the magazine) also is present in the mud test.

Although the test and control magazines did not perform reliably, the test magazine satisfies the test criterion.

2.10 WATER IMMERSION TEST

2.10.1 Objective

The objective was to determine the relative function performance of the test and control magazines after immersion and cleaning in water.

2.10.2 Criterion

The material durability and operational reliability of the test magazine must be equal to or surpass that of the control magazine.

2.10.3 Method

The magazines previously conditioned in the static dust test were used. Each magazine was disassembled and immersed in water for 1 minute. While immersed, the inside and outside of the magazine were cleaned with a soft bristle brush (bottle brush). The magazine was removed from the water, reassembled, loaded and test functioned in a clean, lubricated M16A1 rifle.

A total of 20 loaded magazines was tested in four rifles; five magazines per rifle.

2.10.4 Results

The results of this test are given in Table 2.10-I.

Table 2.10-I. Water Immersion Test Data for Test and Control Magazines

APG Weapon No.	Magazine No.[a]	Test Magazines: Cyclic Rate of Fire, rds/min	Test Magazines: Malfunction, BOB	Control Magazines: Cyclic Rate of Fire, rds/min	Control Magazines: Malfunction, BOB
1	301				
	302	840		784	
	303				
	304				
	305				
2	306				
	307	859	1	794	
	308				
	309				
	310				
3	311				
	312	831		897	
	313				
	314				
	315				
4	316				
	317	849		889	
	318				
	319				
	321				
Total			1		0

[a]The magazines previously used in the static dust test were reused in this test. The magazines were cleaned in water during conduct of the immersion test. Each magazine number denotes both a test and control magazine. Twenty rounds were loaded in each magazine.

2.10.5 Analysis

The magazines are not adversely affected by immersion in water; therefore, the test criterion has been satisfied. Additionally, both magazine types are readily cleansed with water.

2.11 SOLVENTS AND LUBRICANTS COMPATIBILITY TEST

2.11.1 Objective

The objective was to determine the compatibility of the test magazines with various chemical compounds used as cleaners, lubricants, and insecticides.

2.11.1 Criterion

The durability and functional operation of the test magazines must not be degraded by reaction of the various chemical compounds to the test magazine material.

2.11.3 Method

Forty unloaded test magazines, five per fluid type (three new magazines and two used in previous tests), were immersed for 10 minutes in the following fluids: bore cleaner (MIL-L-372B), gasoline, kerosene, diesel fuel, dry cleaning solvent (PS 661-B), VV-L-800 oil, MIL-L-14107 oil, and MIL-L-46000A semifluid oil. All magazines were allowed to drain for 24 hours at ambient range temperature, then loaded with 20 cartridges and test functioned. Insect repellant (FSN 6840-558-0918) was applied to five loaded magazines by coating the hands with the repellant and then immediately grasping the magazines. A check was made to insure that the feed-lip area was contacted. Twenty-four hours elapsed before test firing.

All magazines were inspected during the various stages of this test. The extent of functional performance degradation and reaction between the chemicals and test material, if experienced was determined.

2.11.4 Results

The results of this test are given in Table 2.11-I.

Visual inspection of the test magazines during conditioning and after test firing revealed no damage to the material caused by reaction to the solvents, lubricants, or insecticide.

Table 2.11 I. Solvents and Lubricants Compatibility Test Data

Test Condition	No. of Malfunctions, by Type[a]	Round No. of Malfunction	Weapon No.
Bore cleaner	b		1
Gasoline	1-BOB	6	2
Kerosene	-		3
Diesel fuel	-		4
PS 661-B solvent	1-FF	4	1
VV-L-800 oil	-		2
MIL-L-14107 oil	-		3
MIL-L-46000A semifluid oil	-		4
Insect repellant	-		1

[a]Five 20-round magazines were fired in each test.
[b]No occurrence.

2.11.5 Analysis

The test magazines satisfied the test criterion.

2.12 DISPLACEMENT - TIME STUDY

2.12.1 Objective

The objective was to measure the response characteristics of the cartridge follower in the test magazines during automatic fire, and to compare these measurements with similar measurements for the standard magazine.

2.12.2 Criteria

Criteria are as follows:

a. No more than 10 milliseconds shall be required for the cartridge follower to position a cartridge during automatic fire.

b. Other characteristics of the test magazine shall be judged to be equal to or surpass that of similar characteristics in the standard magazine.

2.12.3 Method

An M16A1 rifle, No. 1096779, was modified by cutting two vertical viewing ports through the left wall of the magazine well of the lower receiver. In order not to reduce the strength and rigidity of the magazine well, the ports did not extend through the lower rolled edge of the well. The ports were spaced approximately 1.75 inches from one another and vertically in line with each end of the cartridge follower within the magazine. Matching viewing ports were then cut through the left side of each of the magazines employed in the test except that only one port was used on any single plastic magazine in order not to unduly weaken the plastic magazine shell.

Small, highly polished, cylindrical rods were then cemented at each end of the cartridge follower. Reflected light from the rods provided traces which were recorded by the displacement - time camera and permitted accurate measurements to be made of displacement versus time for each end of the follower as the follower was elevated in the magazine during a 20-round burst. However, because of camera lens limitations, it was not possible to record both ends of the follower simultaneously with the camera positioned to obtain maximum expansion of the follower trace. As a result, separate records were made to obtain front and rear follower displacement.

In addition to the vertical viewing ports which were cut in the magazine well, a horizontal port was also cut in the upper receiver through the wall opposite the bolt carrier. A small rigid pin was then installed in the carrier which acted as a trigger by contacting a switch mounted on, and projecting downward from, the rifle carrying handle. The switch fired a high-intensity strobe light which imprinted a fine line on the displacement - time records at a predetermined point in the carrier cycle for each round fired. For this test, the strobe index line was set to vertically intersect the cartridge follower trace on the record at the point at which the bolt face contacted each round as the burst was fired.

Three records each were then obtained with a standard magazine, with the orginally received plastic magazine, and with a plastic magazine with a modified follower (rectangular profile cartridge configuration). The initial three records for each type magazine were obtained to show traces of the rear of the cartridge follower. The test was then repeated to obtain similar traces for the front of the cartridge follower.

2.12.4 Results

Representative positions of several displacement - time records are shown in Figure 2.12-1 and 2.12-2 and measurements obtained from the displacement - time records are given in Table 2.12-1.

Figure 2.12-1 illustrates the beginning and end of several automatic bursts which were fired with a standard magazine and with the original plastic magazine. The letters F and R in parenthesis indicate whether the trace is for the front (F) or for the rear (R) of the follower. The numbers on each trace identify the round number and the arrows leading from each number indicate the point at which the follower attained full upward positioning of the cartridge.

The letter X identifies a critical area of follower motion on the records and the arrow leading from each X shows where this area of displacement occurred. The straight vertical lines on the records, labeled BF, are strobe light index lines and indicate, at the point where they intersect the trace of the follower, that the bolt face was just contacting the next cartridge to be stripped from the magazine.

Representative traces for the plastic magazine with modified follower are shown in Figure 2.12.2 and the identifying symbols are the same as in Figure 2.12-1.

By comparing traces on the left with those on the right in the two figures, it can be seen that a very pronounced downward deflection of the follower occasionally occurs as the bolt strips a round from the magazine. This characteristic is most noticeable on the traces obtained with the standard magazine, although this characteristic is not necessarily objectionable if the follower recovers quickly and if the follower is deflected downward without fore and aft tipping.

Figures 2.12-1 and 2.12-2 show that the downward deflection is overcome quickly and, in most instances, the follower is deflected downward without tipping. The degree of tipping can be estimated by comparing the trace on the left (front of the follower) with the trace on the right (rear of the follower). Note, for example how nearly identical the bottom left and bottom right traces are for initially-fired rounds in the standard magazine in Figure 2.12-1, but that pronounced tipping occurs as final rounds (18, 19, and 20) are stripped from the standard magazine and, as the magazine empties, the front of the follower remains stable but the rear of the follower is deflected sharply downward during each cycle.

This characteristic has been previously reported in Reference 5 where it has been cited as at least partially responsible for certain feeding failures encountered with the M16A1 rifle. At best it is an undesirable characteristic and, in comparison to the standard magazine, was not nearly as pronounced with either of the test plastic magazines.

The topmost trace on the right in Figure 2.12-1, however, shows a different and even more undesirable characteristic which was common to the originally received plastic magazine. Note in this trace that the follower has fully elevated to the empty-magazine position just prior to the bolt face reaching the 20th and final cartridge to be stripped. This resulted in the final round escaping from under the feed lip and becoming loose on top of the magazine. This failure occurred in 5 of the 6 displacement - time trials with the original plastic magazine.

Figure 2.12-2 shows that the modified plastic magazine tends to overcome both of the undesirable characteristics of follower tipping and cartridge retention and the data in Table 2.12-1 show that the modified plastic magazine also met the criteria of not exceeding a 10-millisecond response time as did also the standard and original plastic magazines.

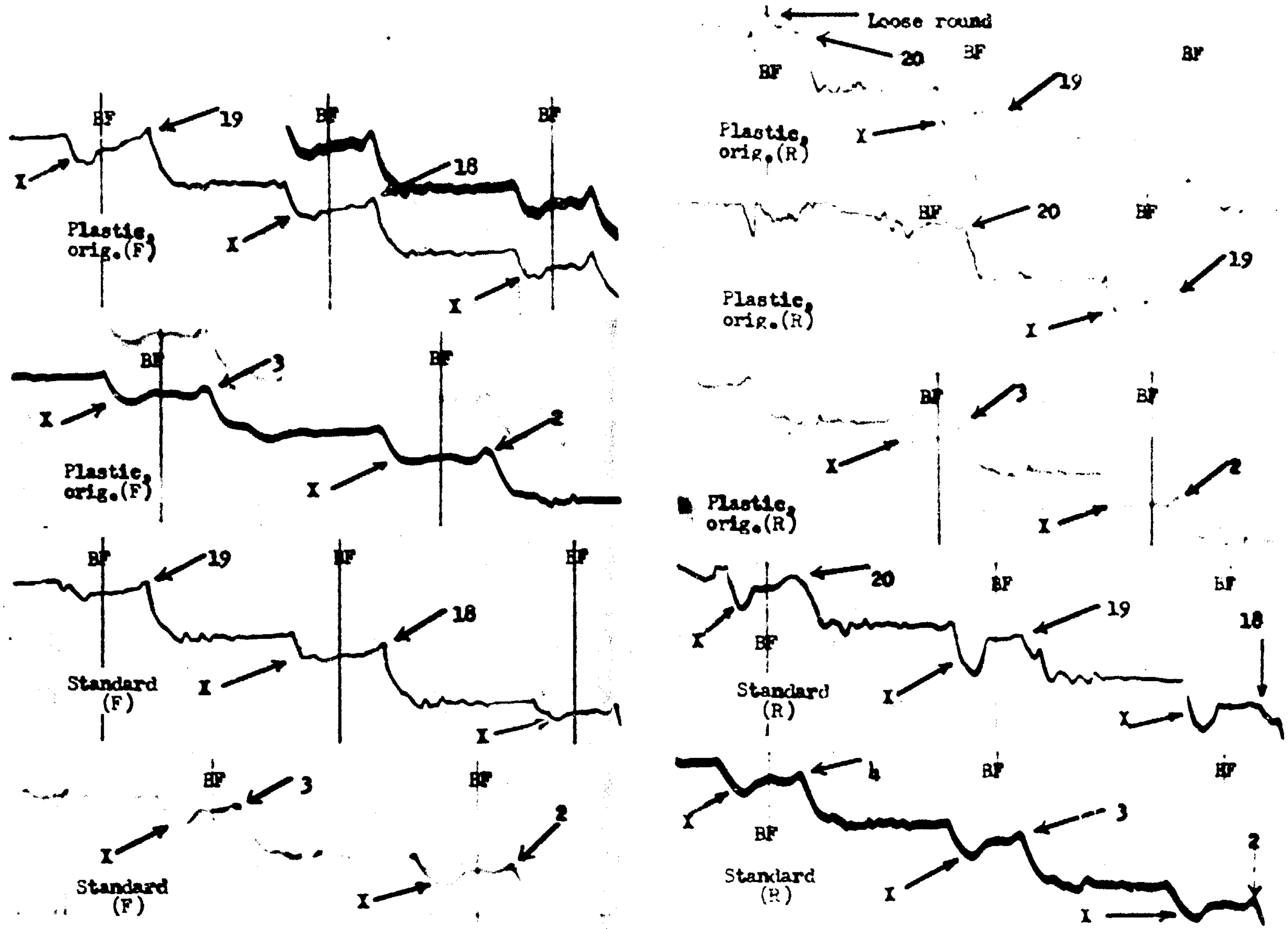


Figure 2.12-1: Portions of Displacement - Time Records Showing Motion of the Cartridge Follower in the Standard Magazine and in the Test Plastic (Original) Magazine. Explanation Is Contained in the Text. Double Traces on the Two Upper Left Records Are Trace Reflections of a Cartridge on Top of the Follower.

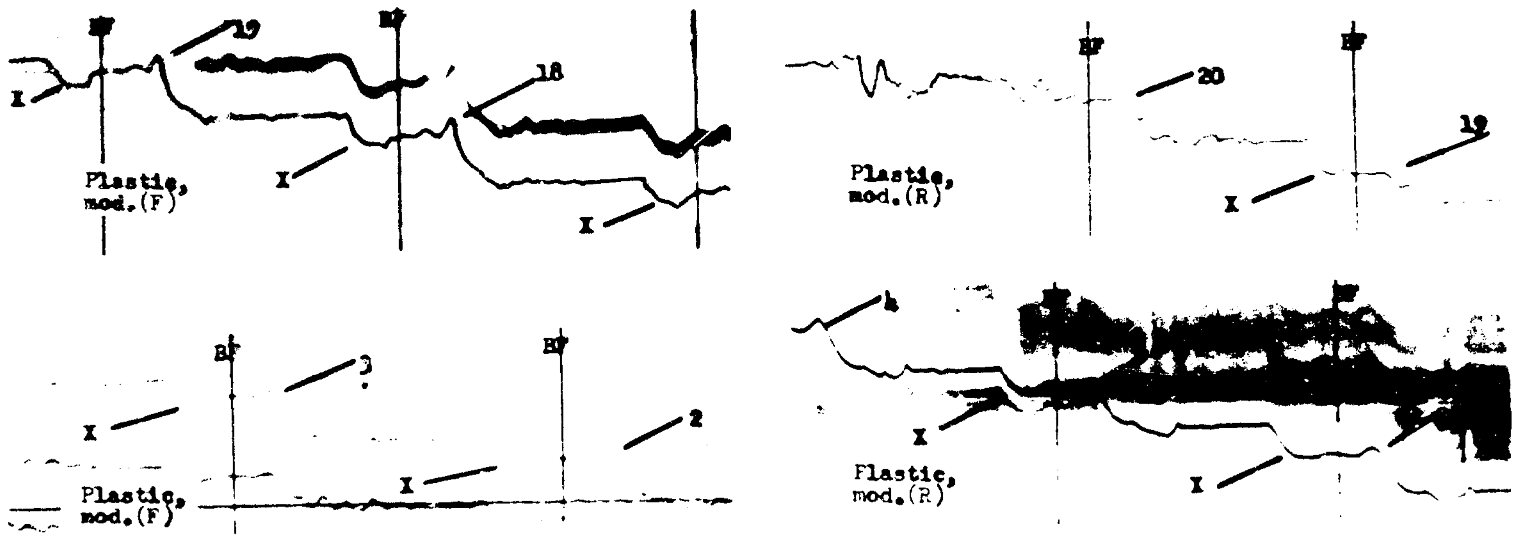


Figure 2.12-2. Portions of Displacement - Time Records Showing Motion of the Cartridge Follower in the Test Plastic (Modified) Magazine. Explanation Is Contained in the Text. Double Traces on the Two Records at Left Are Trace Reflections of a Cartridge on Top of the Follower (Upper Record) and of a Magazine Spring Coil Under the Follower (Lower Record)

Table 2.12-I. Cartridge Follower Measurements Obtained from Displacement Time Records

Plastic magazine, modified follower, measurements taken at rear of follower.

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
6	2	78	8	10	U	S	-
	3	76	7	10	S	D	0.02
	11	72	7	10	S	S	-
	12	73	7	11	S	S	-
	19	73	5	9	S	S	-
	20	72	7	8	S	S	-
7	2	77	9	10	U	S	-
	3	74	7	9	U	D	.02
	11	74	6	10	S	S	-
	12	77	9	13	S	S	-
	19	74	9	9	S	S	-
	20	73	11	9	S	S	-
8	2	80	10	10	S	S	-
	3	75	10	9	S	D	.02
	11	77	8	12	S	S	-
	12	79	7	12	S	S	-
	19	74	9	9	S	S	-
	20	74	8	10	S	S	-
Avg			8.0	10.0			.02

Plastic magazine, original follower, measurements taken at rear of follower.

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
9	2	76	7	9	S	S	-
	3	74	7	9	U	D	0.02
	11	72	6	10	S	D	.03
	12	73	6	10	S	S	-
	19	74	7	7	S	D	.06
	[f]20	-	5	7	-	-	-

See footnotes page 55.

Table 2.12-I (Cont'd)

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
10	2	74	6	10	S	S	-
	3	74	9	9	U	D	0.02
	11	76	6	12	S	D	.03
	12	73	6	11	S	S	
	18	71	10	8	S	S	-
	19	69	5	5	S	D	.06
	[g]20	70	5	13	-	-	-
11	2	81	9	10	S	S	
	3	76	7	9	S	D	.02
	11	74	6	10	S	D	.02
	12	76	6	12	S	D	.02
	19	76	7	7	S	D	.05
	20	72	6	12	S	D	.04
Avg			6.6	9.5			.03

Standard magazine, measurements taken at rear of follower.

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
12	2	78	[h]NR	10	S	D	0.05
	3	73	9	8	S	D	.05
	11	75	7	11	S	D	.06
	12	74	7	12	S	D	.05
	19	75	10	9	S	D	.11
	20	75	10	8	S	D	.06
13	2	79	[h]NR	10	S	D	.05
	3	75	9	9	S	D	.04
	11	75	8	10	S	D	.05
	12	76	7	11	S	D	.04
	19	75	11	7	S	D	.10
	20	71	10	7	D	D	.06

See footnotes page 55.

Table 2.12 I (Cont'd)

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
14	2	82	[h]NR	12	S	D	.05
	3	77	9	11	S	D	.05
	11	75	9	12	S	D	.03
	12	79	10	8	S	D	.06
	19	73	11	6	S	D	.10
	20	76	12	8	S	D	.06
Avg			9.3	9.4			.06

Plastic magazine, modified follower, measurements taken at front of follower.

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
[i]25	2	76	9	8	S	S	-
	3	72	9	6	S	D	0.03
	11	72	8	10	S	D	.05
	12	70	10	11	S	D	.04
	18	70	7	12	S	S	-
	19	69	6	12	S	D	.04
[i]26	2	79	11	9	S	S	-
	3	75	12	8	S	D	.03
	11	69	7	8	S	D	.05
	12	70	8	9	S	D	.04
	17	70	6	12	D	D	.03
	18	68	8	12	D	D	.04
[i]27	2	82	8	11	S	S	-
	3	77	9	11	S	D	.03
	11	75	8	12	S	D	.04
	12	72	8	10	U	D	.04
	18	71	5	13	S	S	
	19	73	5	14	S	D	.04
Avg			8.0	10.4			04

See footnotes page 55.

Table 2.12.1 (Cont'd)

Plastic magazine, original follower, measurements taken at front of follower.

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
21	2	90	8	14	S	S	
	3	85	7	13	S	D	0.04
	11	77	7	13	S	D	.04
	12	76	7	12	S	S	
	18	75	8	15	S	S	
	[f]19	77	5	16	S	D	.03
23	2	93	8	15	S	S	
	3	88	7	14	S	D	.04
	11	75	10	13	S	D	.04
	12	70	10	10	S	D	.04
	18	71	5	13	S	S	-
	[f]19	71	7	14	S	D	.06
24	2	90	8	14	S	S	-
	3	90	7	14	S	D	.04
	11	75	8	13	S	D	.04
	12	75	7	12	S	S	-
	18	72	5	14	S	S	-
	[f]19	72	7	14	S	D	.05
Avg			7.3	13.5			.04

Standard magazine, measurements taken at front of follower.

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cyclic Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
[i]16	2	91	9	15	S	S	-
	3	80	9	10	S	D	0.05
	11	83	8	12	S	D	.04
	12	84	8	12	S	D	.04
	18	78	6	15	S	S	-
	19	84	6	17	S	S	-

See footnotes page 55.

Record No.	Round No.	Cycle Time, ms[a]	Follower Response Time, ms[b]	Cycle Margin, ms[c]	Follower Motion at Bolt Contact[d]	Follower Motion after Bolt Contact[d]	Follower Displacement, in.[e]
[i]17	2	86	9	11	S	D	0.05
	3	79	11	8	S	D	.05
	11	77	7	8	S	D	.04
	12	76	9	9	S	D	.04
	18	74	5	14	S	S	
	19	74	5	13	S	S	
[i]20	2	89	10	13	S	D	.05
	3	78	8	8	D	D	.04
	11	74	6	8	D	D	.05
	12	75	8	11	D	D	.04
	18	79	7	16	S	S	-
	19	80	6	16	S	S	-
Avg			7.6	12.0			.04

[a]The time in milliseconds from the firing of the previous round to the firing of the round listed in round No. column.

[b]The time for the follower (front or rear) to fully elevate a cartridge after the bolt has cleared the magazine in recoil.

[c]The time between initial full positioning of the cartridge to be fed next from the magazine and the arrival of the bolt in counterrecoil to strip the cartridge.

[d]The letters U, D, and S indicate the motion of the follower just as the bolt first engages the cartridge to be stripped and in the next column, immediately after stripping; U=follower moving upward, D= follower moving downward, S=follower is stable or relatively stable (some minor movement detectable).

[e]This measurement shows how far the follower is deflected downward as a cartridge is stripped from the magazine.

[f]The 20th round was not maintained in position in the magazine and became loose on top of the magazine approximately 4 milliseconds before the bolt was in position to strip the round. The gun jammed and did not fire the final round.

[g]A [illegible] round [illegible]ed as in f above but the round was successfully fed and fired.

[h]NR = Not recorded on displacement - time record.

[i]Motion of the follower was not visible for the 20th and occasionally the 19th round due to restrictions imposed in the cutaway viewing port.

[illegible] Analysis

The displacement - time records show that the modified plastic magazines, at least in a "clean" environment, should perform equal to and probably better than the standard magazine. However, other subtests results should be consulted for performance during adverse conditions, for durability, and for handling and loading characteristics.

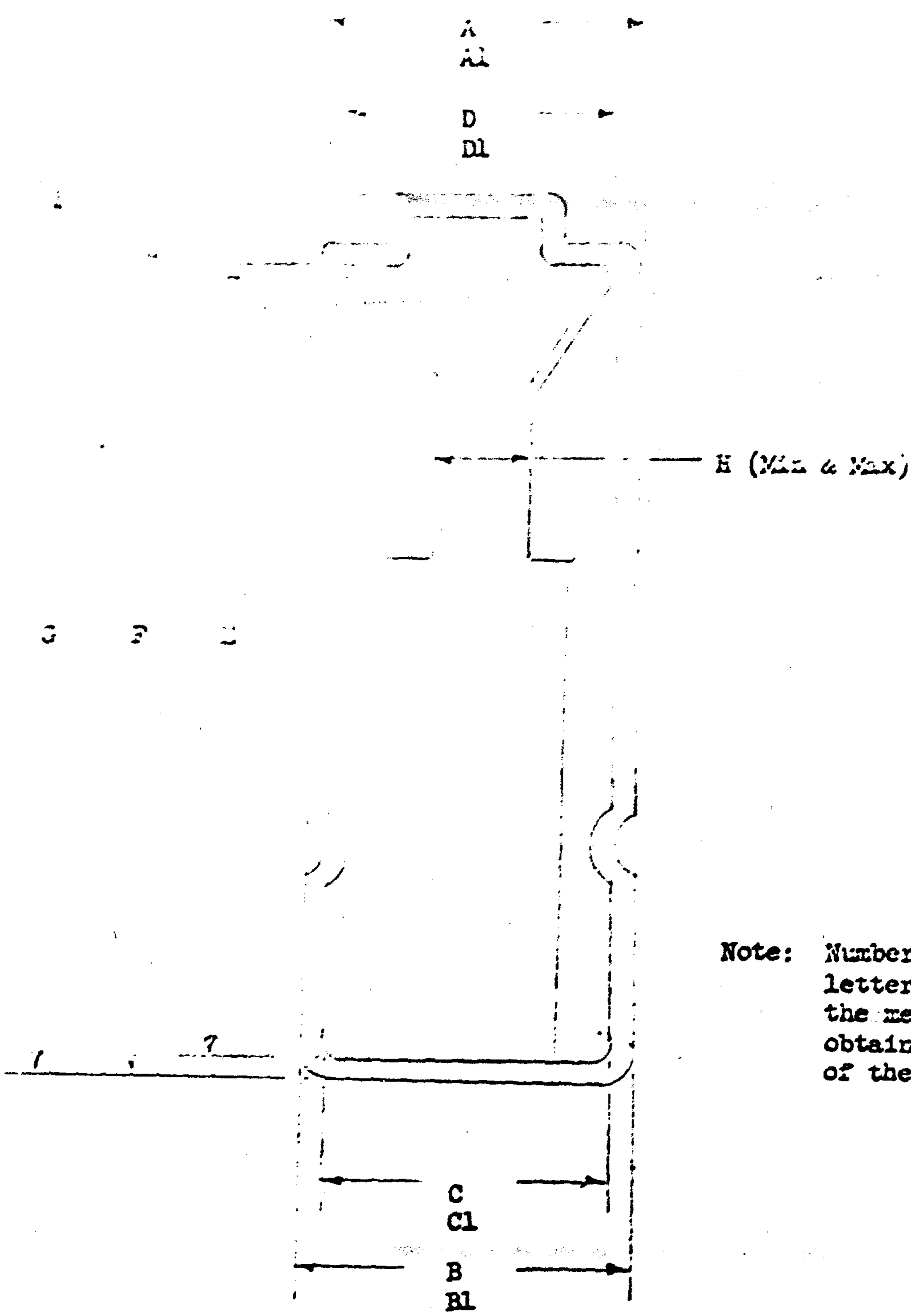
APPENDIX I - TEST DATA

This appendix contains the following test data:

Appendix Page No.	Description of Content	Reference to Section 2 Par. No.	Reference to Section 2 Page No.
I-2	Magazine dimensional measurements.	2.2	9
I-38	Firing sequence for -65°F.	2.3	20
I-39	Firing sequence for +155°F.	2.4	25
I-40	Malfunction and nonfiring defects data for +155°F.	2.4	27
I-41	Cyclic rate of fire data for +155°F.	2.4	28
I-44	Firing sequence for Part I (five loadings) of function and durability test.	2.5	30
I-45	Firing sequence for Part II (50 loadings) of function and durability test.	2.5	30
I-46	Cyclic rate of fire data for function and durability test.	2.5	30
I-49	Malfunction data for function and durability test.	2.5	30
I-50	Magazine array used in the static dust test.	2.6	31
I-51	Malfunction data for mud test.	2.9	43

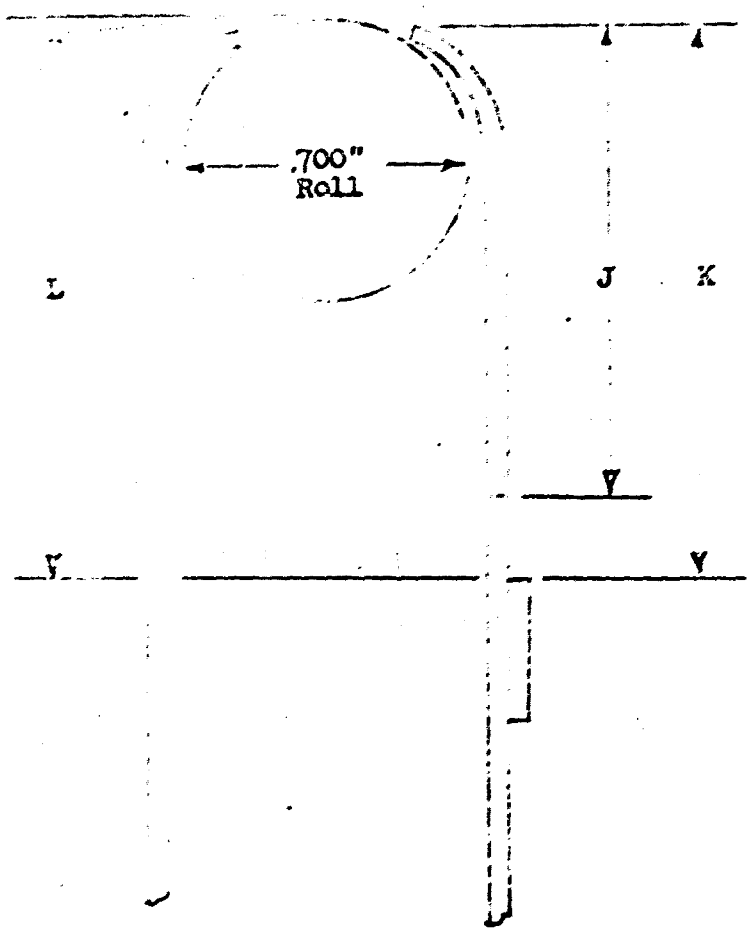
Magazine Dimensional Measurements

... - Magazine, Body
(Top View)

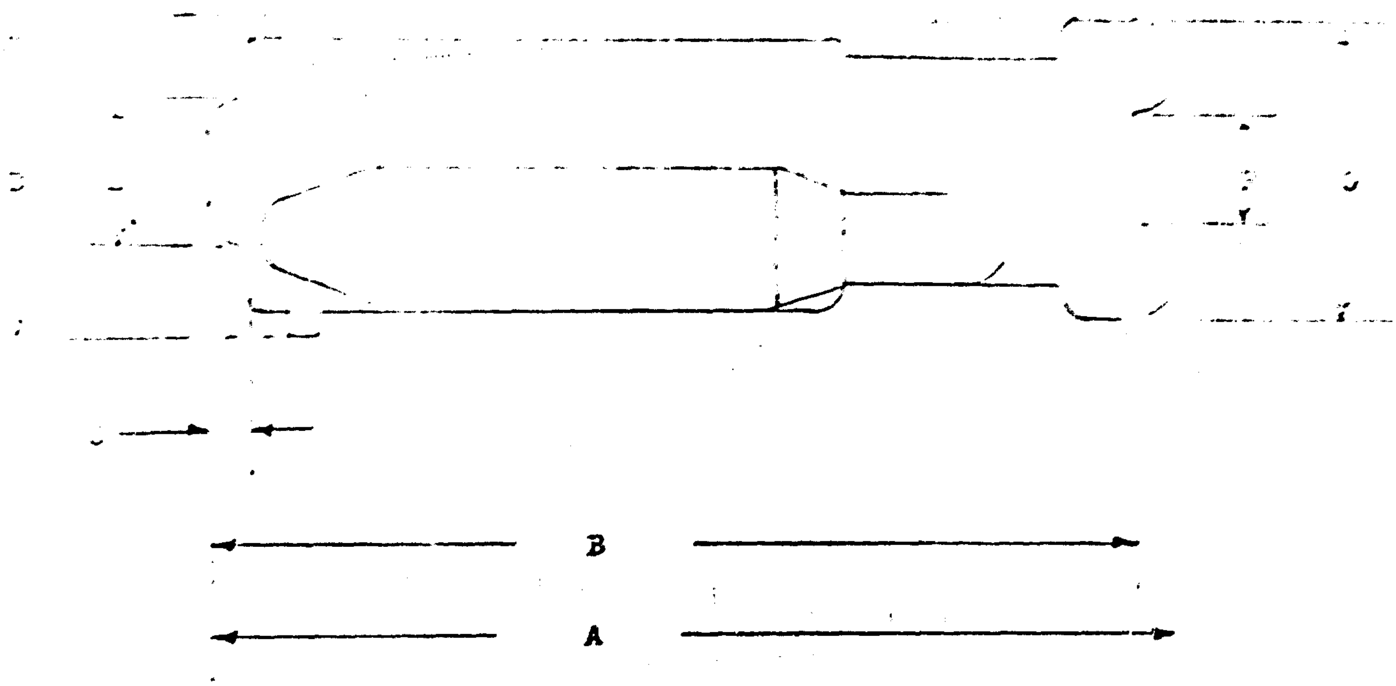


Note: Number 1 beside the letter denotes that the measurement was obtained at the bottom of the magazine.

[illegible] - Magazine, Body
([illegible] View)



(Top View of Follower)



5.56-mm RIFLE

SPECIFICATIONS FOR PLASTIC MAGAZINES

DWG. NO. D4-1042-3 SH 1 of 1

[illegible] *	[illegible]
[illegible]	.8[illegible]0 −.015
[illegible]	.8[illegible]0 −.015
[illegible]	.8[illegible]0 −.015
[illegible]	.8[illegible]0 −.015
[illegible]	.700 +.010
C.	.700 +.010
D	.700 +.010
D.	.700 +.010
E	2.295 +.010
F	2.395 −.010
G	2.540 −.015
H	.445 +.015
J	1.118 −.006
K	1.364 TO 1.380 (Computed)
L	1.396 TO 1.412 (Computed)

* Skeleton No's 1 and 2

[illegible]

SPECIFICATIONS FOR PISTOL MAGAZINES

FOLLOWER, DWG NO C 4 1042-5

Dimension*	SIZE
A	2 265 – .010
B	2.225 to 2.195
C	.110 ± .010
D	.680 ± .005
E	.310 – .010
F	.395 to .445 (Computed)
G	.680 ± .005

SPRING, DWG. No. C 4-1042-8

SPRING LENGTH (FREE)	7.84 – .20

* [illegible]

Reference Sketch 1

Plastic

(Dimension)

Mag. No.	A	A1	B	B1	C	C1	D	D1
5	.887	.375	.889	.883	.712	.725	.713	.722
10	.889	.375	.891	.882	.712	.725	.716	.722
15	.887	.372	.887	.886	.712	.725	.713	.722
20	.887	.375	.889	.882	.711	.725	.713	.722
25	.885	.375	.889	.881	.710	.725	.716	.722
30	.886	.372	.889	.882	.710	.726	.717	.722
35	.886	.372	.889	.881	.709	.725	.712	.722
40	.887	.372	.889	.881	.710	.725	.714	.722
45	.887	.373	.888	.880	.710	.725	.713	.722
50	.887	.373	.890	.882	.711	.725	.714	.722
55	.887	.374	.889	.881	.711	.725	.714	.722
60	.889	.373	.890	.882	.712	.725	.712	.720
65	.883	.373	.889	.883	.710	.725	.717	.723
70	.887	.374	.889	.882	.711	.725	.715	.724
75	.888	.372	.889	.882	.712	.725	.713	[illegible]
80	.886	.373	.889	.882	.712	.725	.711	.722
85	.888	.373	.889	.881	.710	.725	.714	.722
90	.888	.374	.890	.881	.712	.725	.716	.722
95	.887	.374	.889	.879	.712	.725	.717	.722
100	.887	.374	.890	.880	.711	.725	.713	.722

Reference Sketch 1

Aluminum

(Dimension)

Mag. No.	A	A1	B	B1	C	C1	D	D1
5	.884	.887	.884	.884	.796	.804	.800	.805
10	.884	.883	.885	.885	.803	.805	.801	.800
15	.887	.888	.883	.887	.803	.805	.805	.806
20	.883	.884	.884	.888	.800	.806	.804	.804
25	.884	.885	.882	.884	.799	.803	.803	.805
30	.887	.883	.884	.882	.800	.803	.805	.803
35	.870	.885	.884	.885	.797	.802	.794	.802
40	.882	.883	.882	.882	.796	.802	.801	.803
45	.881	.883	.883	.886	.800	.802	.799	.801
50	.883	.884	.885	.885	.800	.804	.798	.798
55	.885	.884	.884	.883	.801	.803	.803	.804
60	.882	.881	.882	.887	.800	.804	.802	.800
65	.884	.887	.886	.885	.803	.802	.800	.805
70	.886	.885	.886	.893	.801	.811	.805	.803
75	.878	.884	.882	.885	.800	.807	.790	.804
80	.890	.885	.884	.883	.790	.800	.805	.801
85	.882	.881	.881	.886	.799	.806	.800	.800
90	.886	.878	.882	.886	.797	.805	.805	.797
95	.883	.884	.882	.885	.798	.800	.800	.802
100	.885	.885	.885	.886	.799	.805	.805	.802

Reference Sketch 1 & 2

Plastic

(Dimension)

Mag. No.	E	F	G	(Min) H	H (Max)	J	K	L
5	2.281	2.393	2.537	.451	.453	1.106	1.366	1.400
10	2.286	2.395	2.535	.450	.459	1.109	1.366	1.403
15	2.279	2.390	2.538	.450	.456	1.107	1.367	1.400
20	2.280	2.390	2.535	.452	.460	1.109	1.375	1.402
25	2.279	2.389	2.537	.449	.455	1.107	1.367	1.402
30	2.283	2.392	2.537	.440	.450	1.108	1.368	1.400
35	2.281	2.390	2.537	.440	.451	1.108	1.366	1.402
40	2.281	2.390	2.542	.444	.451	1.107	1.367	1.402
45	2.283	2.392	2.537	.444	.454	1.109	1.370	1.402
50	2.282	2.392	2.536	.441	.454	1.108	1.367	1.402
55	2.281	2.391	2.535	.444	.459	1.107	1.367	1.403
60	2.281	2.392	2.537	.451	.459	1.108	1.368	1.405
65	2.283	2.391	2.538	.447	.454	1.107	1.367	1.400
70	2.284	2.393	2.538	.447	.456	1.108	1.368	1.401
75	2.286	2.393	2.535	.448	.455	1.108	1.368	1.400
80	2.281	2.390	2.535	.448	.458	1.108	1.370	1.403
85	2.280	2.389	2.536	.448	.458	1.109	1.369	1.405
90	2.281	2.391	2.536	.448	.458	1.108	1.366	1.400
95	2.281	2.391	2.535	.448	.453	1.108	1.368	1.400
100	2.281	2.391	2.540	.442	.457	1.106	1.367	1.402

Reference Sketch 1 & 2

Aluminum

(Dimension)

Mag. No.	E	F	G	(Min) H	(Max) H	J	K	L
5	2.300	2.375	2.531	.451	.452	1.100	1.352	1.390
10	2.300	2.378	2.533	.452	.455	1.101	1.357	1.405
15	2.298	2.369	2.528	.456	.460	1.103	1.349	1.395
20	2.296	2.376	2.528	.450	.458	1.103	1.358	1.408
25	2.295	2.376	2.530	.450	.459	1.102	1.358	1.408
30	2.295	2.376	2.529	.457	.462	1.102	1.355	1.404
35	2.294	2.378	2.531	.449	.455	1.101	1.359	1.408
40	2.297	2.371	2.526	.450	.458	1.100	1.351	1.398
45	2.290	2.369	2.526	.448	.455	1.100	1.345	1.406
50	2.299	2.379	2.530	.448	.455	1.104	1.358	1.405
55	2.293	2.373	2.526	.450	.454	1.100	1.353	1.403
60	2.295	2.379	2.529	.452	.459	1.105	1.356	1.405
65	2.303	2.373	2.529	.452	.454	1.101	1.357	1.402
70	2.298	2.379	2.533	.448	.456	1.108	1.357	1.405
75	2.292	2.376	2.521	.454	.464	1.102	1.356	1.405
80	2.300	2.381	2.526	.448	.455	1.104	1.355	1.400
85	2.294	2.376	2.527	.450	.459	1.100	1.354	1.406
90	2.300	2.373	2.528	.454	.464	1.102	1.355	1.407
95	2.298	2.381	2.521	.442	.448	1.105	1.357	1.400
100	2.295	2.371	2.523	.452	.459	1.100	1.353	1.398

Reference Sketch 3

Plastic

(Dimension)

Mag. No.	A	B	C	D	E	F	G	Spring Length (Free)
5	2.363	2.320	.105	.677	.307	.385	.691	8.075
10	2.370	2.323	.106	.677	.307	.371	.692	8.063
15	2.367	2.319	.106	.677	.309	.378	.693	8.006
20	2.368	2.321	.106	.678	.307	.376	.693	8.130
25	2.367	2.321	.106	.677	.308	.381	.693	8.054
30	2.367	2.322	.105	.678	.308	.383	.693	8.055
35	2.368	2.322	.105	.677	.308	.378	.692	8.020
40	2.368	2.323	.107	.677	.307	.383	.692	7.915
45	2.369	2.323	.105	.677	.307	.399	.693	8.053
50	2.368	2.321	.105	.677	.307	.392	.693	8.020
55	2.370	2.322	.104	.677	.307	.381	.691	8.106
60	2.369	2.321	.105	.677	.307	.380	.692	8.225
65	2.368	2.323	.107	.677	.305	.380	.691	8.154
70	2.369	2.321	.104	.677	.305	.366	.692	8.059
75	2.365	2.322	.105	.678	.307	.385	.692	8.005
80	2.368	2.322	.106	.676	.306	.39[illegible]	.692	8.005
85	2.369	2.321	.107	.676	.306	.383	.691	8.038
90	2.368	2.322	.104	.677	.305	.373	.691	8.045
95	2.369	2.321	.104	.677	.305	.380	.693	8.154
100	2.368	2.321	.107	.677	.305	.387	.692	8.053

Reference Sketch 1

Aluminum

(Dimension)

Mag. No.	A	B	C	D	E	F	G	Spring Lgth. (Free)
5	2.362	2.275	.107	.686	.323	.292	.744	7.798
10	2.359	2.280	.105	.682	.323	.291	.744	7.817
15	2.358	2.268	.110	.682	.316	.285	.745	7.657
20	2.358	2.272	.108	.682	.321	.300	.741	7.726
25	2.361	2.270	.108	.684	.323	.291	.737	7.695
30	2.361	2.277	.107	.688	.323	.293	.744	7.667
35	2.361	2.270	.111	.688	.322	.293	.759	7.765
40	2.358	2.275	.108	.679	.315	.290	.749	7.675
45	2.360	2.274	.108	.684	.323	.295	.747	7.730
50	2.358	2.274	.108	.685	.319	.292	.746	7.749
55	2.362	2.276	.108	.688	.323	.293	.746	7.829
60	2.359	2.275	.107	.687	.318	.295	.754	7.727
65	2.360	2.276	.107	.685	.321	.291	.742	7.754
70	2.358	2.273	.102	.683	.320	.291	.747	7.647
75	2.359	2.274	.106	.682	.319	.291	.739	7.704
80	2.359	2.268	.109	.683	.315	.290	.751	7.675
85	2.359	2.276	.110	.686	.316	.290	.746	7.660
90	2.359	2.272	.108	.686	.322	.292	.744	7.678
95	2.358	2.274	.111	.679	.313	.293	.743	7.636
100	2.359	2.277	.105	.683	.322	.290	.747	7.585

Variations in the dimensions of 20 plastic and 20 aluminum magazines were as follows:

Reference Sketch 1

Plastic

(Dimension)

A	A1	B	B1	C	C1	D	D1
.885 to .889	.872 to .875	.887 to .891	.879 to .888	.709 to .712	.725 to .726	.711 to .717	.718 to .724

Aluminum

A	A1	B	B1	C	C1	D	D1
.870 to .890	.878 to .888	.881 to .886	.882 to .893	.796 to .803	.800 to .811	.790 to .805	.797 to .806

Reference Sketch 1 & 2

Plastic

(Dimension)

E	F	G	H	J	K	L
2.279 to 2.286	2.389 to 2.395	2.535 to 2.542	.440 to .460	1.106 to 1.109	1.366 to 1.370	1.400 to 1.405

Aluminum

E	F	G	H	J	K	L
2.290 to 2.303	2.369 to 2.381	2.521 to 2.533	.442 to .464	1.100 to 1.108	1.345 to 1.359	1.390 to 1.408

Reference Sketch 3

Plastic

(Dimension)

A	B	C	D	E	F	G	Spring Length (Free)
2.363 to 2.370	2.319 to 2.323	.104 to .107	.676 to .678	.305 to .308	.366 to .399	.691 to .693	7.915 to 8.225

Aluminum

A	B	C	D	E	F	G	Spring Length (Free)
2.358 to 2.362	2.268 to 2.280	.102 to .111	.679 to .688	.313 to .323	.285 to .300	.739 to .759	7.585 to 7.829

Variation in the dimensions of 79 plastic and 80 aluminum magazines was as follows:

Reference Sketch 1

Plastic

(Dimension)

A	B	C	D
.888 to .893	.889 to .892	.704 to .727	.710 to .719

Aluminum

A	B	C	D
.877 to .899	.880 to .890	.800 to .808	.800 to .811

The following measurements are for a sample of ten test and control magazines used in the function and durability test.

The maximum variation from drawing specifications before firing was as follows:

Follower, Plastic, Dwg. C4-1042-5

Specified Dimension		Variation
2.265	-.010	-.001

Magazine, Plastic, Dwg. D4-1042-3

.890	-.015	-.003
.700	+.010	+.016
2.285	+.010	-.006
.445	+.015	-.005
1.118	-.006	-.006

Spring, Steel, Dwg. 04-1042-8

Specified Dimension		Variation
7.84	-.20	+.235

Follower, Aluminum, Dwg. 62494

2.360	-.005	+.002
2.257 to	2.272	+.008
.680	±.005	+.003
.300	±.005	-.015
.750	±.005	-.004

Spring, Steel, Dwg. 62187

7.760	±.100	-.003

Magazine, Aluminum, Dwg. 61927

.443	+.015	+.004
1.101 to	1.110	-.001
1.357	+.003	-.005
1.396 to	1.412	-.006
.885	+.005	-.010
.798 to	.812	-.004

The maximum change in dimensions after firing 1000 rounds was as follows:

Follower, Plastic

Dimension		Change
2.265	-.010	-.003
.680	±.005	-.004
.138	±.010	-.002
.340	±.005	-.002

Spring, Steel

7.84	-.20	-.132

Magazine, Plastic

Dimension			Change
.890		-.015	-.003
.700		+.010	-.002
2.285		+.010	+.004
2.395		-.010	-.012
2.540		-.015	-.002
.445		+.015	+.007
1.118		-.006	+.002
1.364	to	1.380	+.002
1.396	to	1.412	+.005

Follower, Aluminum

2.360		-.005	+.005
2.257	to	2.272	±.006
.110		Ref.	±.005
.680		±.005	-.008
.320		±.005	+.005
.300		±.005	±.001
.750		±.005	-.006

Spring, Steel

7.760		±.100	-.218

Magazine, Aluminum

2.288	Min		±.001
2.380	Ref.		-.002
2.530	Ref.		-.003
.443		+.015	+.008
1.101	to	1.110	-.002
1.357		+.003	-.003
1.396	to	1.412	+.010
.885		+.005	±.001
.798	to	.812	±.001

See following for data and sketch of measurement locations.

Magazine, Plastic, For 5.56 mm., M16 Rifle
Before and After Firing 1000 rounds.

Follower, Dwg. C4-1042-5

Follower No.	Specified 2.265" -.010" B.F. Left Side	B.F. Right Side	A.F. Left Side	A.F. Right Side	Change A.F. vs B.F. Left Side	Change A.F. vs B.F. Right Side	Specified .680 ±.005 B.F.	A.F.	Change A.F. vs B.F.
1	2.256	*2.254	2.255	2.253	-.001	-.001	.679	.681	+.001
2	2.258	2.257	2.255	2.255	.003	.002	.685	.681	-.004
3	2.257	2.257	2.256	2.256	.001	.001	.682	.682	.000
4	*2.254	2.258	2.255	2.255	+.001	.003	.685	.682	-.003
5	*2.254	2.256	2.254	2.254	.000	.002	.680	.681	.001
6	2.256	2.257	2.255	2.254	-.001	.003	.681	.683	.002
7	*2.254	2.255	2.254	2.254	.000	.001	.681	.682	.002
8	2.255	2.255	2.254	2.255	-.001	.000	.680	.681	.001
9	*2.254	2.257	2.254	2.254	.000	-.003	.679	.682	.003
10	2.255	2.258	2.255	2.255	.000	.003	.685	.683	-.002

	Specified .188 ±.010 B.F.	A.F.	Change A.F. vs B.F.	Specified .340 ±.005 B.F.	A.F.	Change A.F. vs B.F.
1	.184	.183	-.001	.341	.341	.000
2	.187	.185	.002	.341	.341	.000
3	.186	.184	.002	.342	.340	-.002
4	.186	.184	.002	.342	.341	.001
5	.186	.185	.001	.342	.341	.001
6	.186	.185	.001	.342	.342	.000
7	.186	.185	.001	.341	.341	.000
8	.186	.185	.001	.343	.343	.000
9	.186	.185	.001	.343	.343	.000
10	.186	.185	.001	.343	.342	-.001

* Does not meet Dwg. Specifications

Spring, Compression, Magazine, Dwg. 04-1042-8
Free Length B.F. and A.F. 1000 rounds.

No.	Specified 7.84" -.20"		Change A.F. vs B.F.	No.	Specified 7.84" -.20"		Change A.F. vs B.F.
5	*8.075	8.014	-.061	30	*8.055	7.986	-.069
10	*8.063	7.931	.132	35	*8.020	7.945	.075
15	*8.006	7.913	.093	40	*7.915	7.845	.070
20	*8.130	8.058	.072	45	*8.053	7.993	.060
25	*8.054	7.963	.091	50	*8.020	7.948	.072

Magazine, Plastic, For 5.56 mm. , M16 Rifle
Before and After Firing 1000 rounds.
Dwg. D 4-1042-3 (See Draft Sketch 1)

Specified Dimension

	.890-.015		.890 -.015		.890 -.015		.890 -.015		.700 + .010	
Magazine	(A)		(A1)		(B)		(B1)		(C)	
No.	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.
5	.887	.887	.875	.873	.889	.889	.883	.880	*.712	.712
10	.889	.889	.875	.874	*.891	.891	.882	.881	*.712	.713
15	.887	.887	*.872	.872	.887	.886	.886	.889	*.712	.712
20	.887	.886	.875	.875	.889	.888	.882	.882	*.711	.711
25	.885	.885	.875	.875	.889	.888	.881	.880	.710	.710
30	.886	.886	*.872	.873	.889	.888	.882	.881	.710	.710
35	.886	.886	*.872	.872	.889	.890	.881	.880	.709	.710
40	.887	.887	*.872	.873	.889	.889	.881	.882	.710	.711
45	.887	.888	*.873	.872	.888	.888	.880	.881	.710	.710
50	.887	.886	*.873	.874	.890	.889	.882	.883	*.711	.711
Max. Change	±.001		-.002		±.001		-.003		+.001	

Specified Dimension

	.700 + .010		.700 + .010		.700 + .010	
	(C1)		(D)		(D1)	
	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.
5	*.725	.725	*.713	.713	*.720	.720
10	*.725	.725	*.716	.717	*.720	.720
15	*.725	.725	*.713	.713	*.722	.723
20	*.725	.724	*.713	.714	*.722	.721
Max. Change	-.002		±.001		±.001	

*Does not meet Dwg. specifications.

25	*.725	.724	*.716	.716	*.722	.721
30	*.726	.724	*.717	.717	*.722	.722
35	*.725	.726	*.712	.712	*.720	.719
40	*.725	.724	*.714	.715	*.720	.720
45	*.725	.725	*.713	.713	*.722	.722
50	*.725	.725	*.714	.713	*.721	.720
Max. Change		-.002		±.001		±.001

Magazine, Plastic, For 5.56 mm., M16 Rifle
Before and After Firing 1000 rounds.
Dwg. D 4-1042-3 (See Ref. sketch 1 & 2)

	Specified Dimension									
	2.285 + .010		2.395 - .010		2.540 - .015		.445 + .015			
Mag.	(E)		(F)		(G)		(H) Min.	Max.	Min.	Max.
No.	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.	B.F.		A.F.	
5	*2.281	2.282	2.393	2.392	2.537	2.538	.451	.453	.455	.456
10	2.286	2.285	2.395	2.383	2.535	2.535	.450	.459	.450	.459
15	*2.279	2.281	2.390	2.390	2.538	2.538	.450	.456	.451	.456
20	*2.280	2.282	2.390	2.388	2.535	2.533	.452	.460	.453	.460
25	*2.279	2.283	2.389	2.388	2.537	2.537	.449	.455	.450	.455
30	*2.283	2.285	2.392	2.393	2.537	2.535	*.440	.450	.441	.452
35	*2.281	2.281	2.390	2.390	2.537	2.535	*.440	.451	.447	.454
40	*2.281	2.281	2.390	2.390	2.542	2.541	*.444	.451	.444	.453
45	*2.283	2.284	2.392	2.389	2.537	2.538	*.444	.454	.444	.456
50	*2.282	2.281	2.392	2.391	2.536	2.536	*.441	.454	.448	.460
Max. Change		+.004		-.012		-.002			+.007	+.006

	Specified Dimension					
	1.118-.006		1.364 to 1.380		1.396 to 1.412	
	(J)		(K)		(L)	
5	*1.106	1.106	1.366	1.367	1.400	1.403
10	*1.109	1.108	1.368	1.367	1.403	1.407
15	*1.107	1.108	1.367	1.367	1.400	1.403
20	*1.109	1.110	1.365	1.367	1.402	1.402
25	*1.107	1.107	1.367	1.366	1.402	1.402
30	*1.108	1.110	1.368	1.367	1.400	1.404
35	*1.108	1.108	1.366	1.366	1.402	1.401
40	*1.107	1.106	1.367	1.367	1.402	1.407
45	*1.109	1.108	1.370	1.369	1.402	1.404
50	*1.108	1.108	1.367	1.367	1.402	1.404
Max. Change		+.002		+.002		+.005

* Does not meet Dwg. Specifications

Magazine, Aluminum, For 5.56 mm., M16 Rifle
Before and After Firing 1000 rounds.

Follower, Dwg. 62494 (See Ref. sketch 3)

	Specified Dimension									
	2.360 ± .005		2.257 to 2.272		.110 Ref.		.680 ± .005		.320 ± .005	
Mag.	(A)		(B)		(C)		(D)		(E)	
No.	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.	B.F.	A.F.
5	*2.362	2.360	*2.275	2.269	.107	.111	*.686	.684	.323	.321
10	2.359	2.364	*2.280	2.277	.105	.110	.682	.684	.323	.322
15	2.358	2.358	2.268	2.274	.110	.113	.682	.682	.316	.321
20	2.358	2.361	2.272	2.269	.108	.112	.682	.679	.321	.319
25	*2.361	2.358	2.270	2.272	.108	.108	.684	.679	.323	.321
30	*2.361	2.357	*2.277	2.272	.107	.106	*.688	.680	.323	.321
35	*2.361	2.359	2.270	2.275	.111	.109	*.688	.683	.322	.323
40	2.358	2.360	*2.275	2.277	.108	.112	.679	.676	.315	.314
45	2.360	2.360	*2.274	2.274	.108	.107	.684	.683	.323	.323
50	2.358	2.358	*2.274	2.273	.108	.110	.685	.678	.319	.321
Max. Change		+.005		± .006		+.005		-.008		+.005

	Specified Dimension			
	.300 ± .005		.750 ± .005	
	(F)		(G)	
5	*.292	.291	*.744	.745
10	*.291	.291	*.744	.744
15	*.285	.285	.745	.744
20	.300	.299	*.741	.744
25	*.291	.291	.747	.742
30	*.293	.293	*.744	.744
35	*.293	.293	.749	.743
40	*.290	.291	.749	.743
45	.295	.294	.747	.743
50	*.292	.292	.746	.743
Max. Change	±.001		-.006	

Spring, Dwg. 62187

Specified Dimension 7.760 ± .100 B.F.	A.F.	Change
7.798	7.680	-.118
7.817	7.710	.107
*7.657	7.585	.072
7.726	7.680	.046
7.695	7.665	.030
7.667	7.559	.108
7.765	7.733	.032
7.675	7.642	.033
7.730	7.661	.069
7.749	7.637	-.112
		-.118

* Does not meet Dwg. Specifications

Magazine, Aluminum, For 5.56 mm., M16 Rifle
Before and After Firing 1000 rounds.

Magazine, Dwg. 61922 **(See Ref.** sketch 1 & 2)

Specified Dimension

Mag. NO.	2.288 Min. (E) B.F	A.F.	2.380 Ref. (F) B.F.	A.F.	2.530 Ref. (G) B.F.	A.F.	.443 +.015 (H) B.F. Min	Max	A.F. Min	Max
5	2.300	2.301	2.375	2.374	2.531	2.531	.451	.452	.452	.452
10	2.300	2.300	2.378	2.276	2.533	2.530	.452	.455	.454	.458
15	2.298	2.298	2.369	2.369	2.528	2.528	.456	*.460	.459	.464
20	2.296	2.297	2.376	2.375	2.528	2.529	.450	.458	.452	.458
25	2.295	2.295	2.376	2.375	2.530	2.529	.450	*.459	.457	.463
30	2.295	2.295	2.376	2.376	2.529	2.529	.457	*.462	.461	.466
35	2.294	2.295	2.378	2.378	2.531	2.530	.449	.455	.457	.460
40	2.297	2.298	2.371	2.371	2.526	2.526	.450	.458	.455	.462
45	2.290	2.290	2.369	2.370	2.526	2.526	.448	.455	.450	.458
50	2.299	2.298	2.379	2.380	2.530	2.528	.448	.455	.454	.460
Max. Change	±.001			-.002		-.003			+.008	+.005

Specified Dimension

	1.101 to 1.110 (J)		1.357 +.003 (K)		1.396 to 1.412 (L)	
5	*1.100	1.100	*1.352	1.353	*1.390	1.394
10	1.101	1.100	1.357	1.354	1.405	1.409
15	1.103	1.101	*1.349	1.350	*1.395	1.404
20	1.103	1.103	1.358	1.357	1.408	1.414
25	1.102	1.103	1.358	1.357	1.408	1.409
30	1.102	1.102	1.355	1.355	1.404	1.409
35	1.101	1.102	1.359	1.356	1.408	1.413
40	*1.101	1.102	*1.351	1.353	1.398	1.406
45	*1.100	1.101	*1.354	1.354	1.406	1.409
50	1.104	1.105	1.358	1.358	1.405	1.415
Max. Change		-.002		-.003		+.010

* **Does not meet Dwg. Specifications**

Magazine, Aluminum, For 5.56 mm., M16 Rifle
Before and After Firing 1000 rounds.

Magazine, Dwg. 61922 (See Ref. sketch 1)

	Specified Dimension									
	.885 +.005		.885 + .005		.885 + .005		.885 + .005		.798 to .812	
	(A)		(AI)		(B)		(BI)		(C)	
No.	**B.F.**	**A.F.**	**B.F.**	**A.F.**	**B.F.**	**A.F.**	**B.F.**	**A.F.**	**B.F.**	**A.F.**
5	.884	.884	.887	.887	.884	.884	.884	.883	*.796	.796
10	.884	.884	.883	.883	.885	.885	.885	.885	.803	.803
15	.887	.887	.888	.888	.883	.883	.887	.886	.803	.803
20	.883	.883	.884	.884	.884	.884	.888	.887	.800	.801
25	.884	.884	.885	.885	.882	.881	.88	.883	.799	.800
30	.887	.887	.883	.883	.884	.884	.882	.883	.800	.800
35	*.870	.869	.885	.884	.884	.884	.885	.884	*.797	.798
40	.882	.882	.883	.884	.882	.882	.882	.882	*.796	.795
45	.881	.881	.883	.884	.883	.883	.886	.885	.800	.800
50	.883	.883	.884	.883	.885	.885	.885	.886	.800	.801
Max. Change	-.001			±.001		-.001		±.001		±.001

	Specified Dimension					
	.798 to .812		.798 to .812		.798 to .812	
	(C1)		(D)		(D1)	
5	.804	.804	.800	.801	.805	.806
10	.805	.805	.801	.801	.800	.801
15	.805	.805	.805	.804	.806	.806
20	.806	.805	.804	.804	.804	.805
25	.803	.804	.803	.803	.805	.805
30	.803	.802	.805	.804	.803	.804
35	.802	.801	*.794	.795	.802	.802
40	.802	.802	.801	.800	.803	.804
45	.802	.802	.799	.800	.801	.801
50	.804	.803	.798	.798	.798	.799
Max. Change		±.001		±.001		+.001

* Does not meet Dwg. Specifications.

Reference Sketch 1

Plastic

(Dimension)

Mag. No.	A	B	C	D	Mag. No.	A	B	C	D
1	.891	.890	.711	.713	43	.891	.890	.716	.716
2	.890	.890	.710	.714	44	.892	.890	.716	.716
3	.889	.891	.711	.711	46	.890	.890	.711	.713
4	.892	.892	.714	.719	47	.892	.891	.710	.715
6	.892	.890	.710	.715	48	.890	.889	.714	.714
7	.892	.890	.711	.710	49	.890	.890	.716	.715
8	.892	.890	.710	.711	51	.889	.891	.715	.713
9	.891	.890	.709	.718	52	.892	.890	.709	.716
11	.893	.890	.712	.710	53	.890	.889	.716	.715
12	.891	.891	.712	.713	54	.892	.890	.714	.716
13	.891	.891	.713	.714	56	.891	.891	.711	.714
14	.891	.892	.712	.711	57	.889	.889	.711	.711
16	.890	.890	.712	.712	58	.888	.889	.710	.712
17	.890	.890	.711	.713	59	.889	.890	.715	.713
18	.891	.891	.711	.719	61	.890	.890	.715	.713
19	.889	.890	.712	.714	62	.890	.889	.717	.714
21	.890	.890	.713	.712	63	.889	.890	.714	.713
22	.890	.890	.715	.714	64	.891	.890	.717	.716
23	.891	.891	.716	.715	66	.889	.890	.714	.713
24	.889	.889	.711	.712	67	.892	.891	.713	.715
26	.890	.889	.717	.712	68	.891	.889	.708	.715
27	.889	.890	.715	.712	69	.891	.889	.712	.714
28	Missing				71	.892	.891	.709	.716
29	.891	.889	.712	.714	72	.891	.891	.713	.713
31	.890	.891	.711	.712	73	.892	.892	.713	.715
32	.891	.890	.713	.713	74	.892	.891	.713	.717
33	.889	.890	.714	.713	76	.891	.891	.712	.714
34	.889	.890	.715	.713	77	.893	.892	.713	.717
36	.889	.890	.709	.712	78	.890	.890	.711	.712
37	.890	.890	.714	.712	79	.892	.890	.714	.714
38	.891	.890	.714	.715	81	.890	.891	.711	.716
39	.892	.890	.710	.718	82	.891	.891	.712	.713
41	.891	.890	.714	.714	83	.890	.890	.708	.712
42	.890	.890	.714	.713	84	.892	.891	.712	.715

Reference Sketch 1

Plastic

(Dimension)

Mag. No.	A	B	C	D
86	.891	.890	.709	.714
87	.890	.890	.715	.713
88	.891	.890	.716	.714
89	.889	.891	.704	.712
91	.889	.890	.716	.713
92	.890	.890	.710	.715
93	.890	.891	.710	.713
94	.892	.890	.716	.715
96	.889	.890	.714	.713
97	.890	.890	.714	.714
98	.890	.891	.712	.714
99	.889	.890	.710	.713

Reference Sketch 1

Aluminum

(Dimension)

Mag. No.	A	B	C	D	Mag. No.	A	B	C	D
1	.884	.886	.804	.805	43	.887	.882	.800	.809
2	.885	.887	.804	.804	44	.882	.885	.805	.805
3	.877	.888	.804	.800	46	.886	.885	.800	.805
4	.883	.885	.805	.802	47	.889	.890	.804	.810
6	.882	.887	.805	.800	48	.885	.884	.801	.806
7	.881	.887	.805	.800	49	.887	.885	.802	.808
8	.883	.887	.804	.804	51	.880	.886	.802	.804
9	.881	.888	.804	.800	52	.885	.885	.804	.807
11	.881	.884	.803	.801	53	.885	.885	.800	.805
12	.884	.885	.805	.805	54	.885	.886	.801	.805
13	.884	.889	.805	.804	56	.882	.883	.802	.806
14	.887	.886	.808	.807	57	.882	.885	.803	.808
16	.881	.883	.804	.804	58	.882	.886	.802	.804
17	.885	.887	.808	.804	59	.884	.881	.802	.801
18	.884	.884	.804	.811	61	.883	.881	.805	.805
19	.885	.885	.800	.811	62	.886	.884	.800	.810
21	.884	.884	.800	.803	63	.885	.885	.800	.805
22	.888	.889	.800	.805	64	.887	.885	.805	.807
23	.887	.885	.800	.805	66	.885	.882	.800	.808
24	.883	.886	.800	.800	67	.882	.884	.800	.800
26	.884	.888	.803	.806	68	.883	.885	.807	.801
27	.887	.887	.800	.808	69	.885	.885	.808	.803
28	.885	.885	.804	.806	71	.884	.887	.808	.803
29	.882	.882	.801	.809	72	.884	.889	.804	.800
31	.890	.890	.800	.807	73	.882	.884	.808	.800
32	.885	.884	.803	.809	74	.881	.884	.805	.802
33	.888	.885	.805	.810	76	.884	.885	.807	.801
34	.884	.887	.800	.805	77	.883	.883	.804	.807
36	.885	.886	.800	.808	78	.881	.885	.804	.800
37	.883	.885	.800	.806	79	.888	.887	.806	.801
38	.884	.884	.802	.810	81	.891	.882	.804	.812
39	.885	.883	.806	.806	82	.886	.884	.806	.802
41	.882	.887	.802	.803	83	.882	.884	.805	.802
42	.885	.887	.800	.805	84	.885	.884	.800	.805

Reference Sketch 1

Aluminum

(Dimension)

Dwg. No.	A	B	C	D
86	.883	.887	.804	.804
87	.885	.880	.800	.804
88	.886	.885	.803	.808
89	.886	.884	.802	.808
91	.887	.886	.805	.809
92	.883	.885	.802	.804
93	.881	.882	.804	.805
94	.887	.885	.800	.805
96	.887	.882	.801	.808
97	.889	.883	.800	.807
98	.889	.883	.800	.809
99	.888	.882	.800	.809

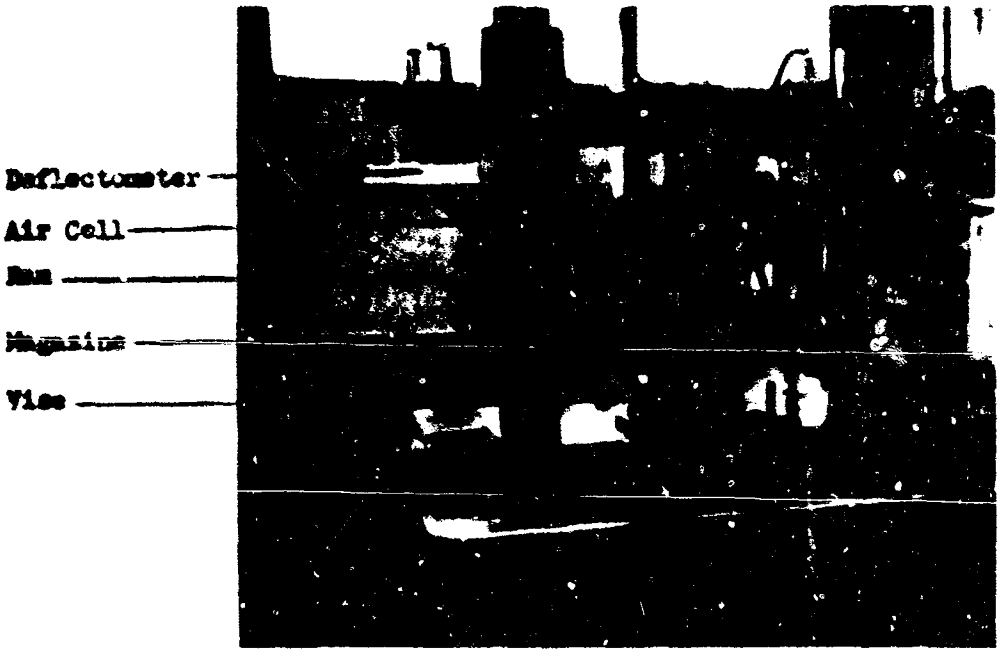
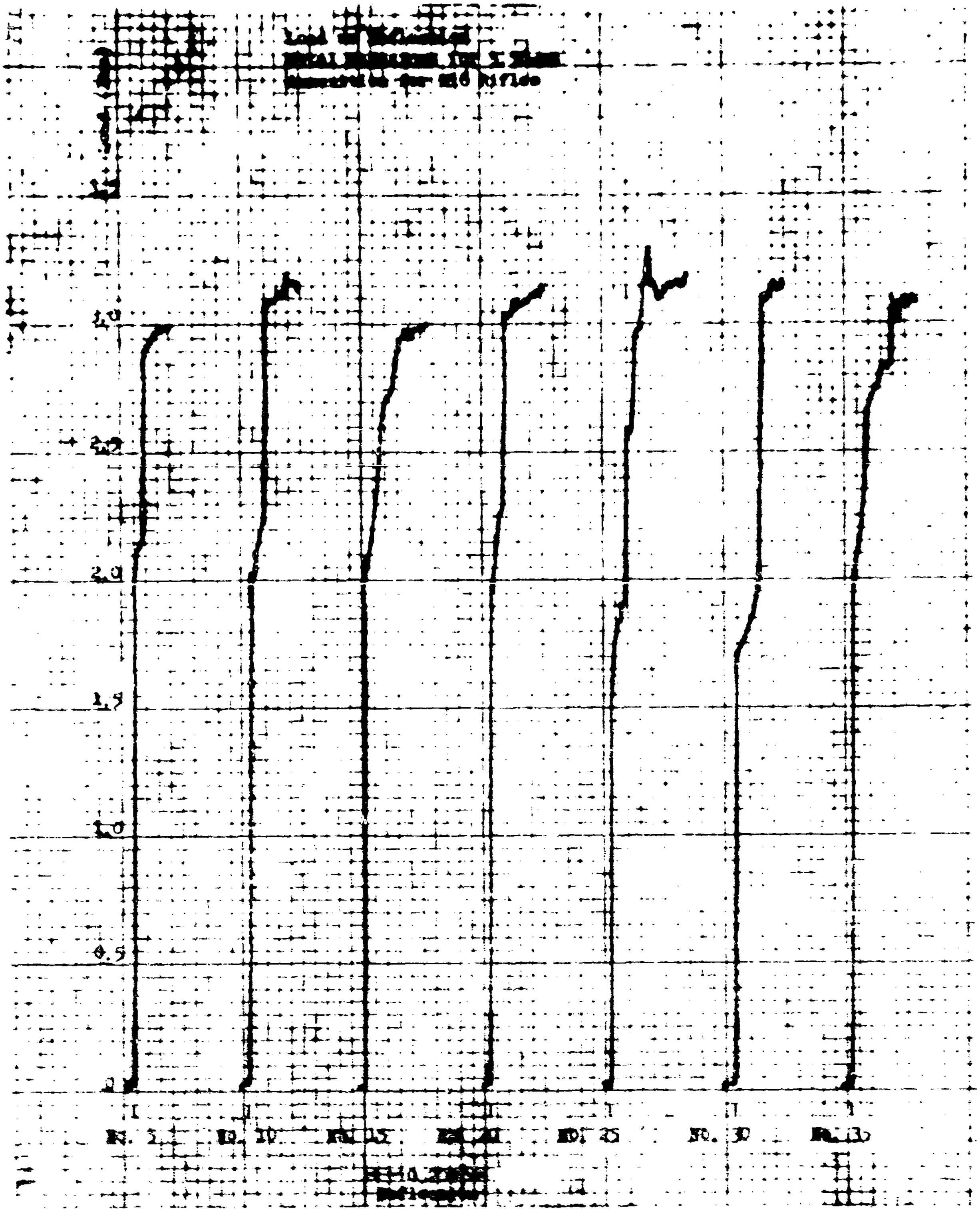


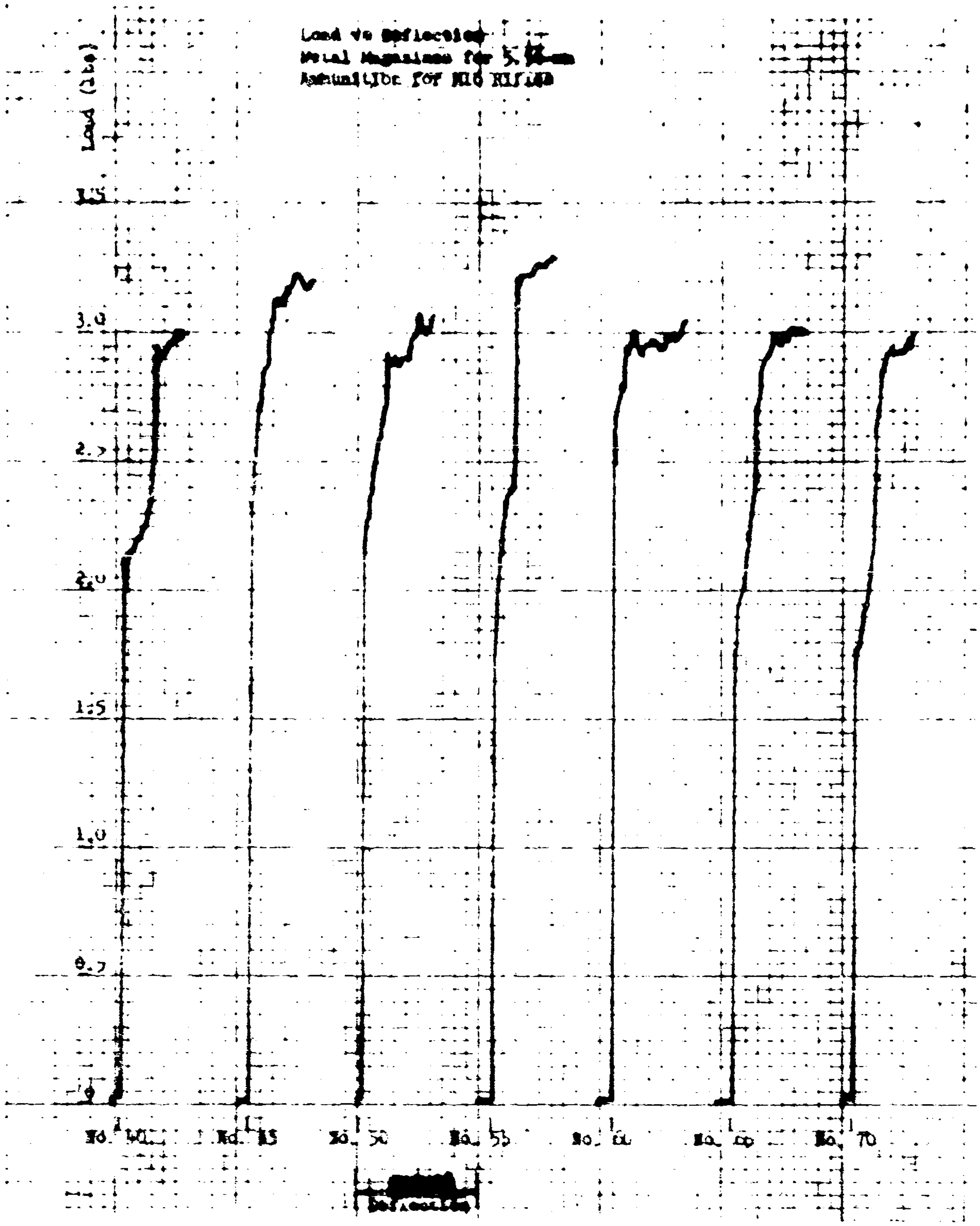
Figure I-1: Setup for Load Deflection Testing of Magazines for 5.56-MM Ammunition for M16 Rifles.

The range of the loads necessary to initiate movement of the spring loaded part of the magazines were:

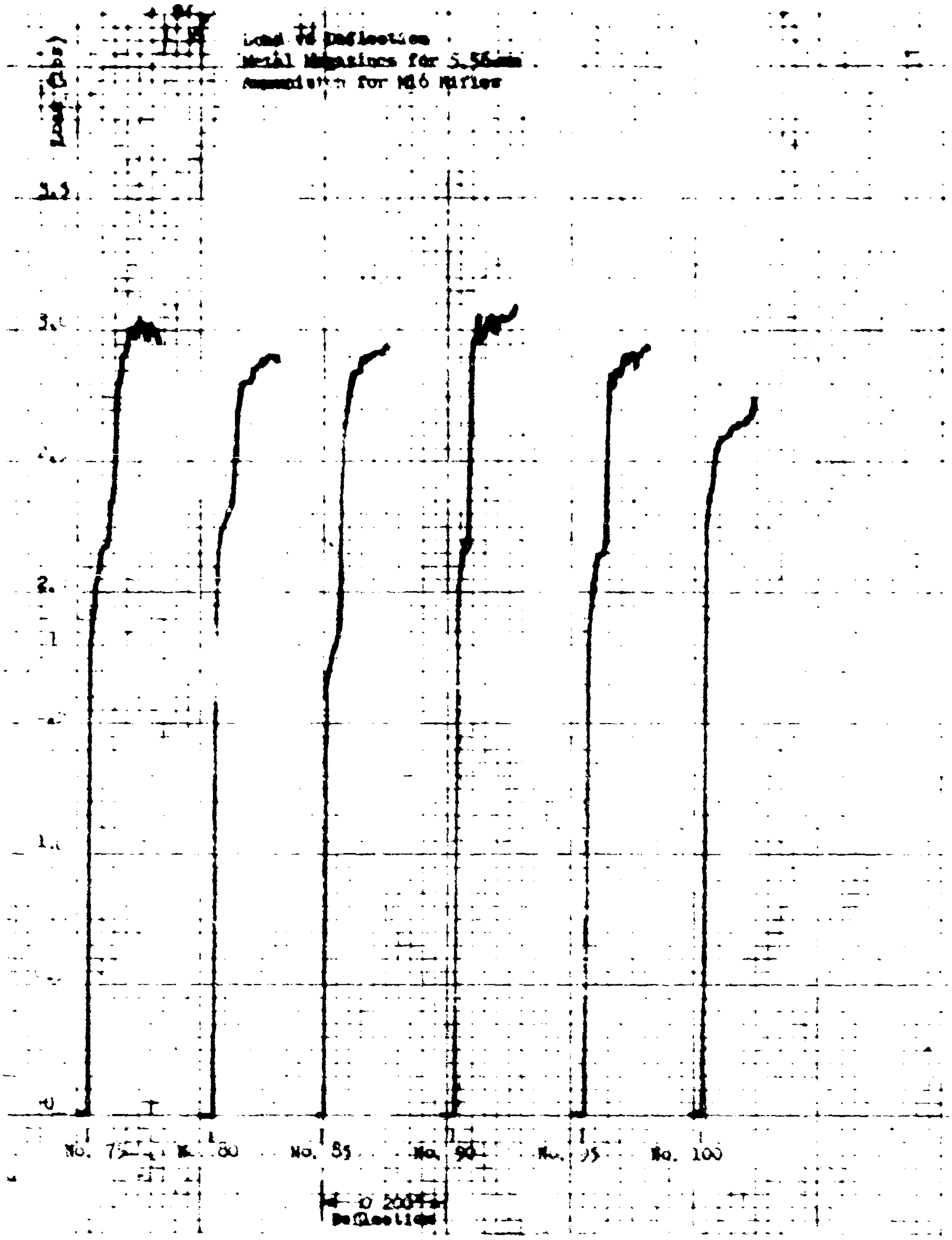
a. Metal: 1.60 to 2.35 pounds (Control Magazine)
b. Plastic (removable base): 1.10 to 2.40 pounds (Present Test Magazine)
c. Plastic (cemented base): 1.35 to 3.50 pounds (Second EDT Test Magazine)

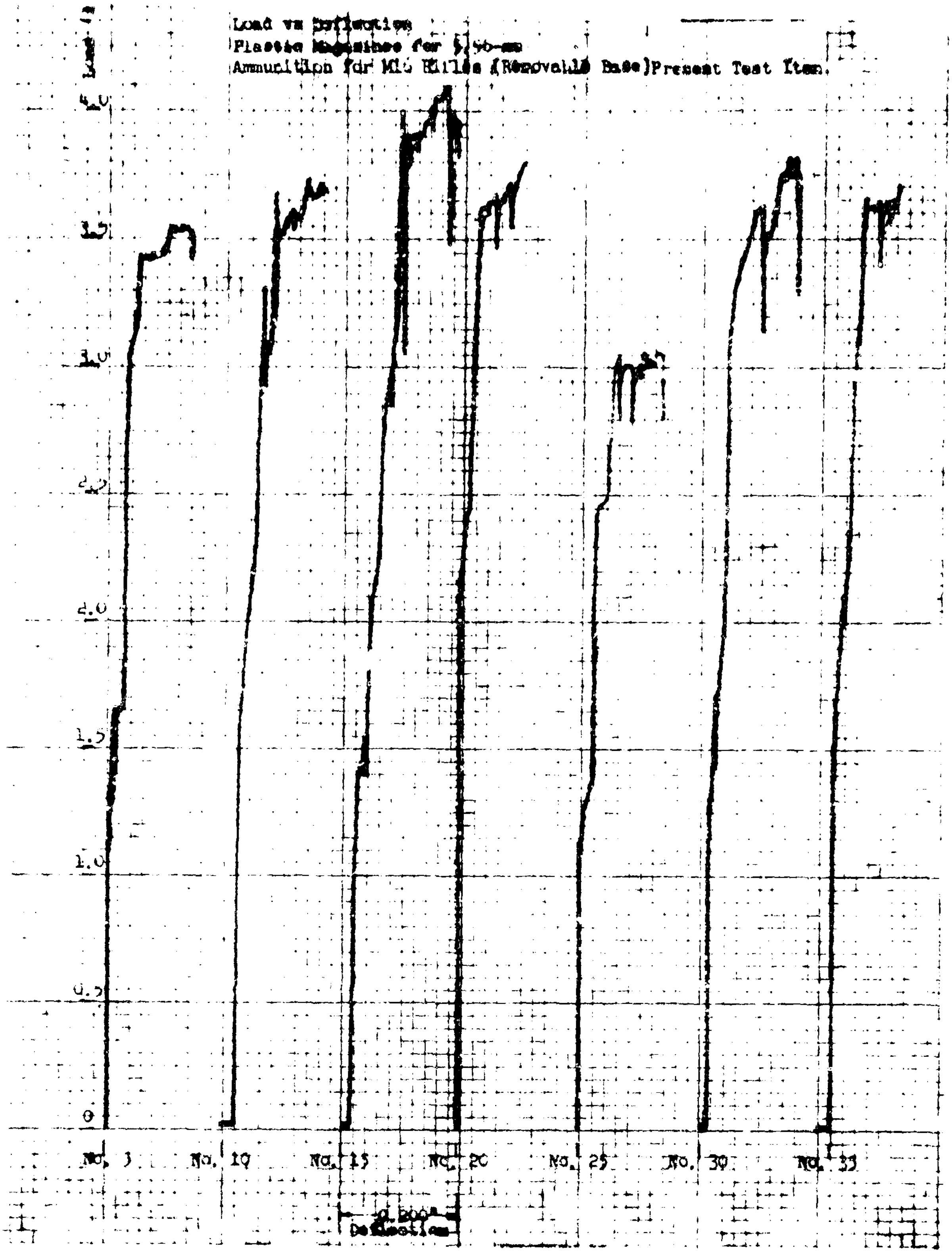
It should be noted that the value of 1.35 pounds for the plastic magazines with the cemented bases is exceptionally low for this group. If this one value were disregarded, the new low would be 2.65 pounds.

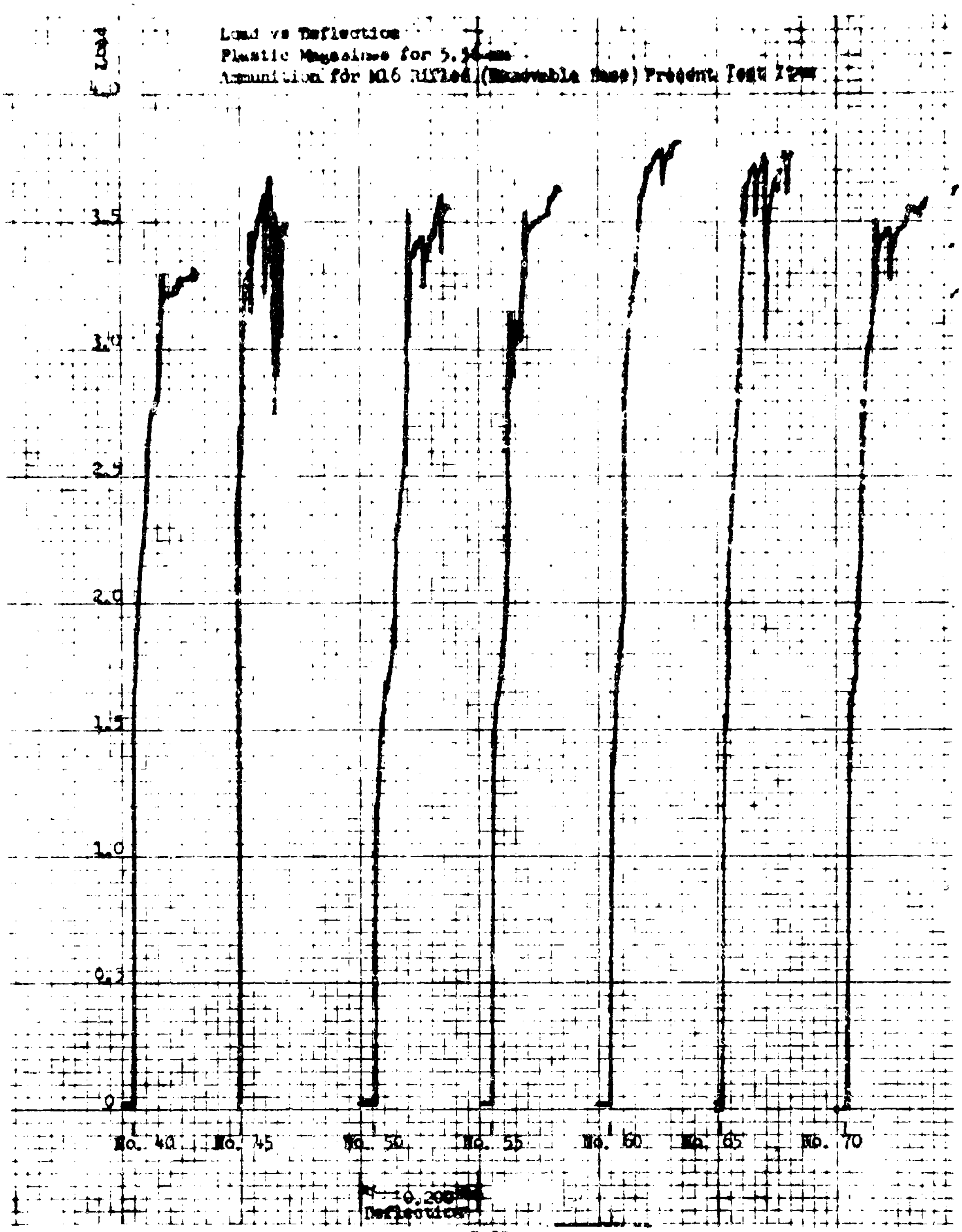


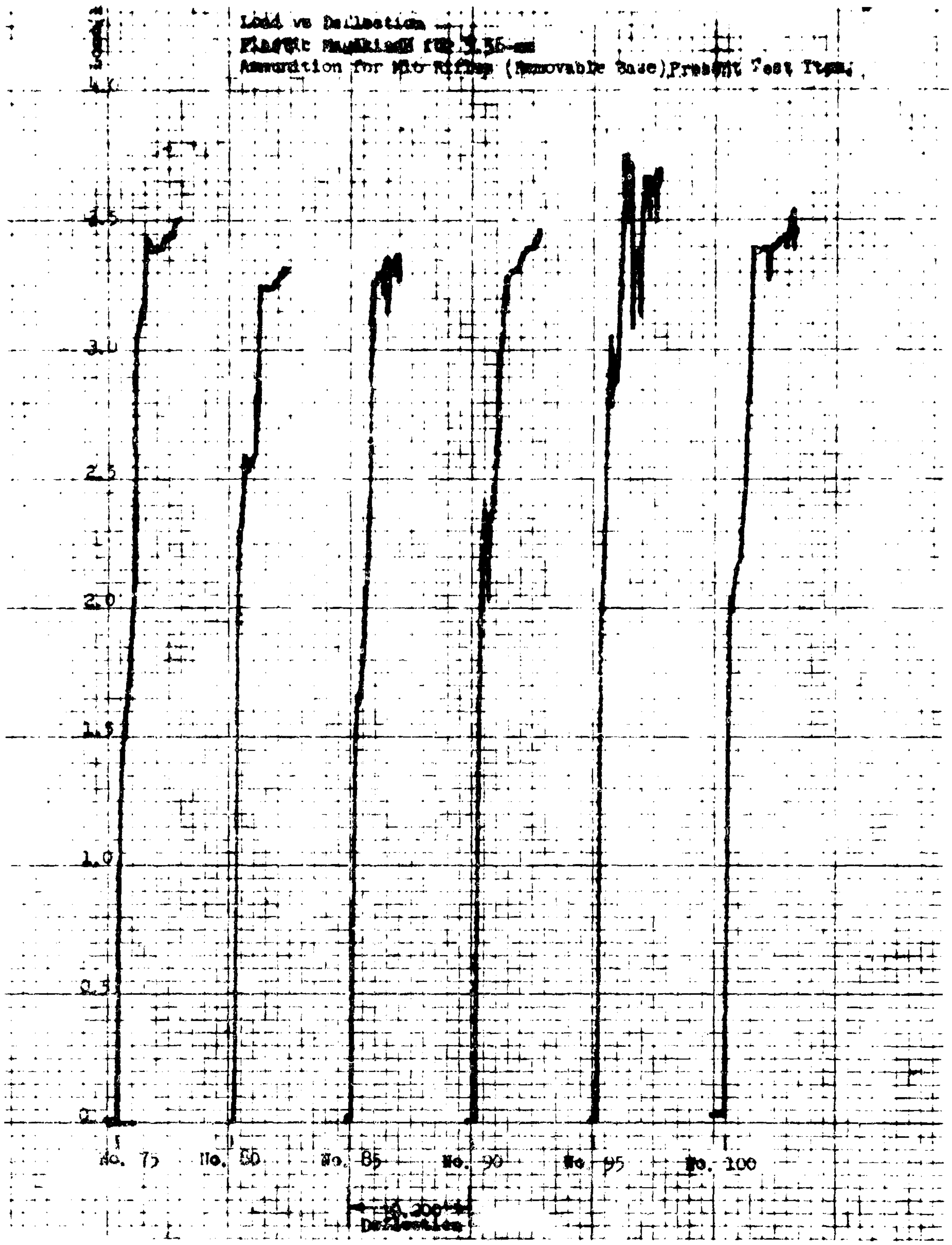


Load vs Deflection
Metal Magazines for 5.56-mm
Ammunition for M16 Rifle
Load (lbs)
3.0
2.5
2.0
1.5
1.0
0.5
0
No. 40
No. 45
No. 50
No. 55
No. 60
No. 65
No. 70
Deflection


Load Vs Deflection
Metal Magazines for 5.56mm
Ammunition for M16 Rifles
Load (lbs)
3.5
3.0
2.
1.0
0
No. 75
No. 80
No. 85
No. 90
No. 95
No. 100
0.200 in
Deflection


Load vs Deflection
Plastic Magazines for 5.56-mm
Ammunition for M16 Rifles (Removable Base) Present Test Item.
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
No. 5
No. 10
No. 15
No. 20
No. 25
No. 30
No. 35
0.200
Deflection


Load vs Deflection
Plastic Magazines for 5.
Ammunition for M16 Rifles
Load
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
No. 40
No. 45
No. 50
No. 55
No. 60
No. 65
No. 70
0.200
Deflection


Load vs Deflection
Plastic Magazine for 5.56-mm
Ammunition for M16 Rifles (Removable Base) Present Test Items
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
No. 75
No. 80
No. 85
No. 90
No. 95
No. 100
Deflection

Dimensional variation for a sample of 10 Second EDT Test magazines.

Measurements are given in inches. Measurements are from new magazines.

Reference Sketch 1

Dimension

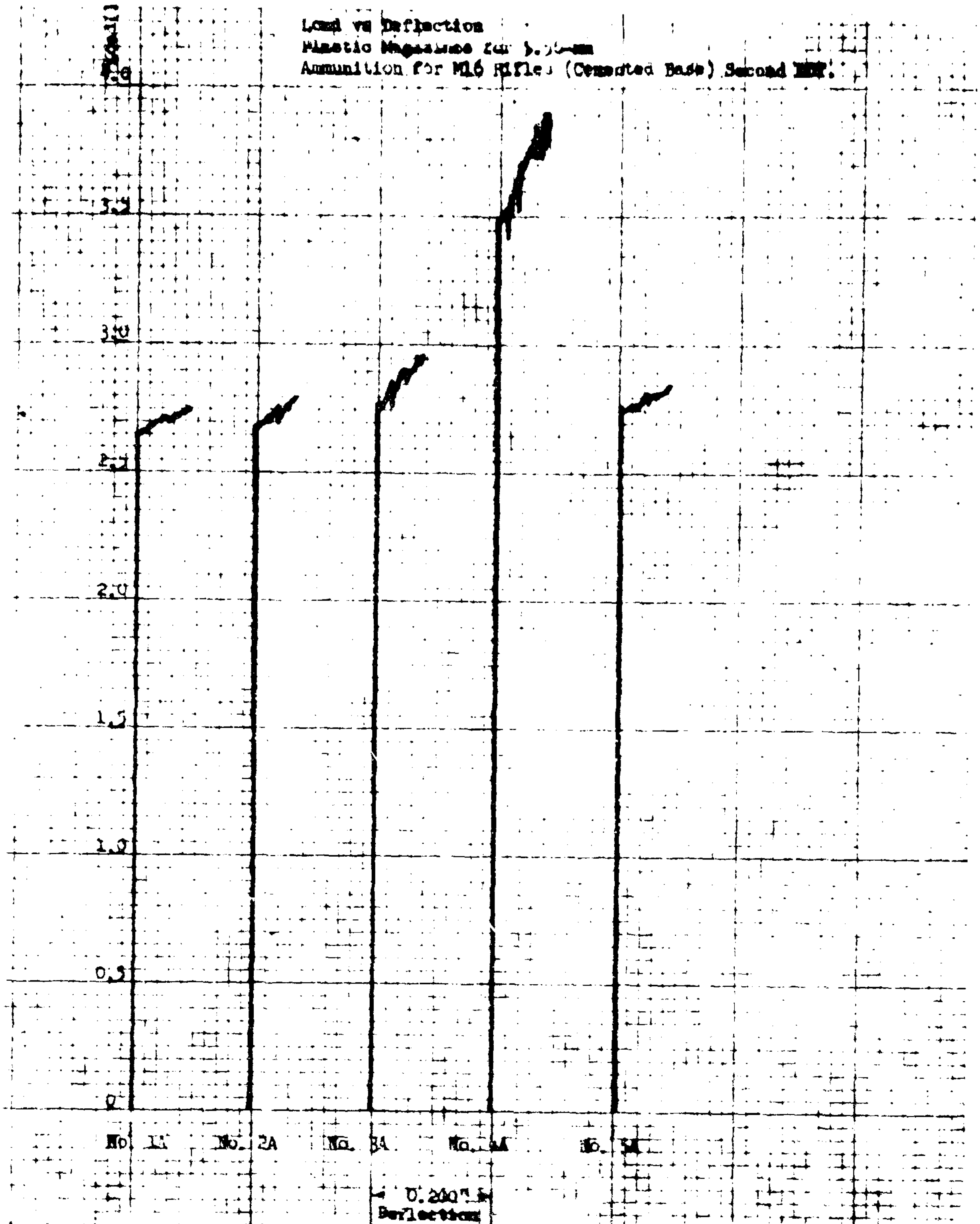
A	A1	B	B1	C	D
.897 to .901	.885 to .892	.891 to .894	.887 to .891	.711 to .715	.716 to .720

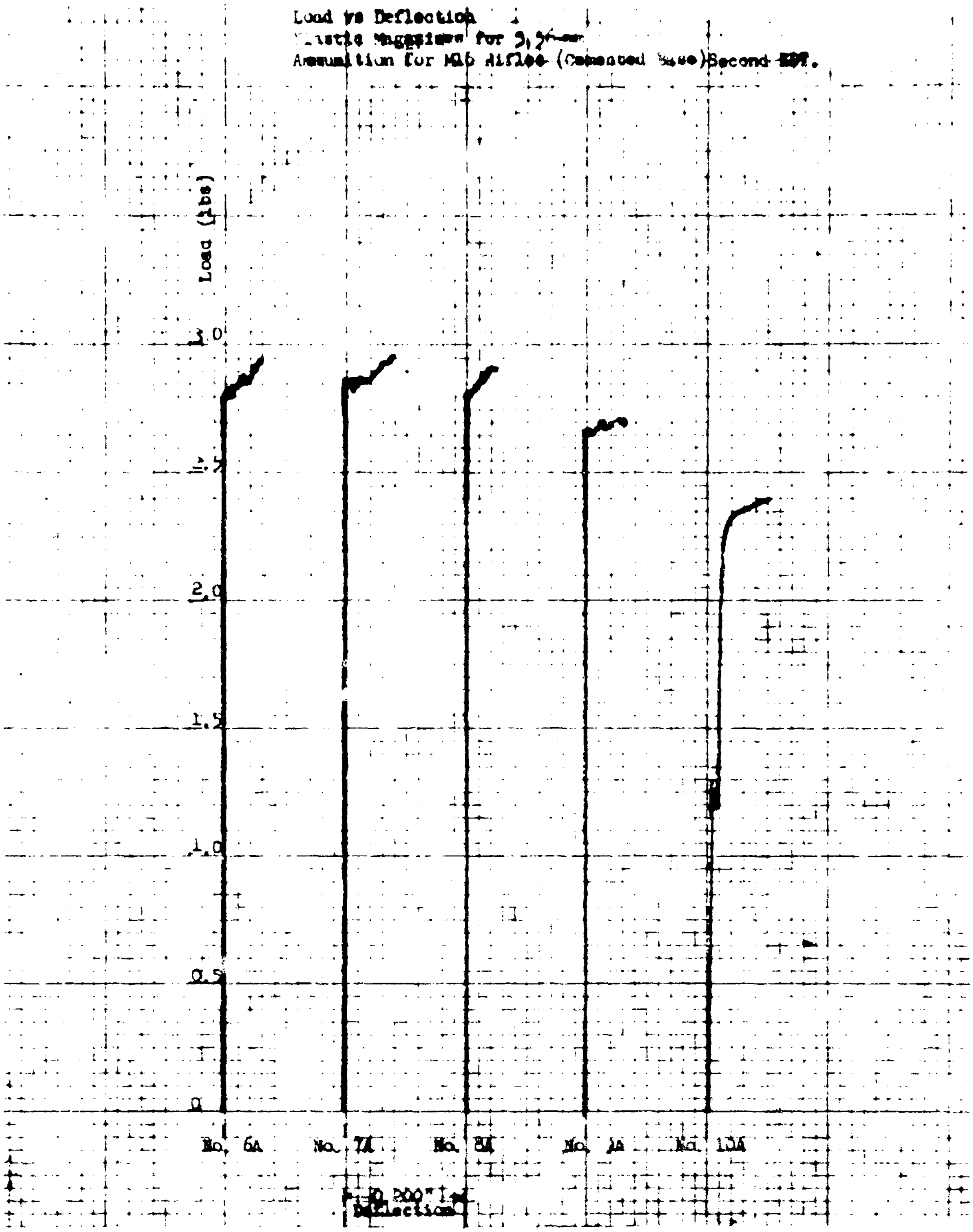
Reference Sketch 1 & 2

Dimension

E	F	G	H	J	K	L
2.282 to 2.296	2.395 to 2.407	2.533 to 2.550	.440 to .471	1.111 to 1.115	1.371 to 1.376	1.442 to 1.453

Load vs Deflection
Plastic Magazine for 5.56-mm
Ammunition for M16 Rifles (Cemented Base) Second [illegible]





Load vs Deflection
Load (lbs)
3.0
2.0
1.5
1.0
0.5
0
No. 6A
No. 7A
No. 8A
No. 10A
Deflection

Table I-I. Firing Sequence for -65°F

Mode of Fire, by Magazine No. B	A	S	B	S	Cycle 1 Wpn No.	Cycle 2 Wpn No.	Cycle 3 Wpn No.	Cycle 4 Wpn No.	Cycle 5 Wpn No.
C101	T101	C102	T102	C103	11	12	13	14	15
T103	C104	T104	C105	T105	12	13	14	15	11
C106	T106	C107	T107	C108	13	14	15	11	12
T108	C109	T109	C110	T110	14	15	11	12	13
C111	T111	C112	T112	C113	15	11	12	13	14
T113	C114	T114	C115	T115	11	12	13	14	15
C116	T116	C117	T117	C118	12	13	14	15	11
T118	C119	T119	C120	T120	13	14	15	11	12
C121	T121	C122	T122	C123	14	15	11	12	13
T123	C124	T124	C125	T125	15	11	12	13	14
C126	T126	C127	T127	C128	11	12	13	14	15
T128	C129	T129	C130	T130	12	13	14	15	11
C131	T131	C132	T132	C133	13	14	15	11	12
T133	C134	T134	C135	T135	14	15	11	12	13
C136	T136	C137	T137	C138	15	11	12	13	14
T138	C139	T139	C140	T140	11	12	13	14	15
C141	T141	C142	T142	C143	12	13	14	15	11
T143	C144	T144	C145	T145	13	14	15	11	12
C146	T146	C147	T147	C148	14	15	11	12	13
T148	C149	T149	C150	T150	15	11	12	13	14

Note: The prefix (C) and (T) to the magazine number represents CONTROL and TEST, respectively.

The modes of fire are abbreviated:(B) for 3- to 5-rd bursts, (A) for 20-rd automatic bursts, and (S) for semiautomatic firing.

Table I-II. Firing Sequence for +155°F

Mode of Fire, by Magazine No.					Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
B	A	S	B	S	Wpn No.	Wpn No.	Wpn No.	Wpn No.	Wpn No.
C151	T151	C152	T152	C153	11	12	13	14	15
T153	C154	T154	C155	T155	12	13	14	15	11
C156	T156	C157	T157	C158	13	14	15	11	12
T158	C159	T159	C160	T160	14	15	11	12	13
C161	T161	C162	T162	C163	15	11	12	13	14
T163	C164	T164	C165	T165	11	12	13	14	15
C166	T166	C167	T167	C168	12	13	14	15	11
T168	C169	T169	C170	T170	13	14	15	11	12
C171	T171	C172	T172	C173	14	15	11	12	13
T173	C174	T174	C175	T175	15	11	12	13	14
C176	T176	C177	T177	C178	11	12	13	14	15
T178	C179	T179	C180	T180	12	13	14	15	11
C181	T181	C182	T182	C183	13	14	15	11	12
T183	C184	T184	C185	T185	14	15	11	12	13
C186	T186	C187	T187	C188	15	11	12	13	14
T188	C189	T189	C190	T190	11	12	13	14	15
C191	T191	C192	T192	C193	12	13	14	15	11
T193	C194	T194	C195	T195	13	14	15	11	12
C196	T196	C197	T197	C198	14	15	11	12	13
T198	C199	T199	C200	T200	15	11	12	13	14

Note: The prefix (C) and (T) to the magazine number represents CONTROL and TEST, respectively.

The modes of fire are abbreviated: (B) for 3- to 5-rd bursts, (A) for 20-rd automatic bursts, and (S) for semiautomatic firing.

Table I-III. Malfunction and Nonfiring Defects Data for +155°F

Magazine Type	No. of Malfunctions, by Type							Non-firing Defects			
	Stub-1	[a]BOB	[b]FF-20	FBR	[c]DF	FF	FC-DR	[e]BL	[f]TI	[f]TE	TOTAL
Test	0	0	58	6	2	[d]1	1	17	0	0	85
Control	1	3	0	1	0	1	0	1	13	6	24

a: Two of the three malfunctions resulted from drop-test damage to the feed-lip area of magazines C157 and C161. The feed-lips were reshaped prior to firing the second cycle. No further malfunctions occurred with these two magazines.

b: These malfunctions were caused by inadequate magazine design. The last rd. in the magazine was ejected from the feed-lips prior to stripping by the bolt. Eighteen of the fifty eight malfunctions required retraction of the charging handle and actuation of the bolt release to clear; the remainder by actuation of the bolt release only as the bolt was locked to the rear.

c: Two magazines were rendered inoperable due to a broken right feed-lip; one during cycle 1, the other during the third cycle.

d: Partial breakage of the right feed-lip allowed retension of only 19 rounds. The magazine completly failed to operate after firing three cycles (ref. c above)

e: Loosening of the floor plate on both test and control magazines did not adversely influence magazine functioning. Test magazine No. T168 was made without a floor plate detent (ref. figure 2.2-1 and I-1). Control magazine No. C160 had a broken floor plate clip rivit (lower) which allowed the floor plate to slide out of position.

f: The tight insertion and retraction of the control magazines was caused by drop-test damage which laterally expanded the sides of the magazines when dropped on the feed-lips. Function performance was not degraded by this condition.

Table I-IV. Cyclic Rate of Fire Data for $+155^{o}F$

Trial No.	Weapon No.	Magazine No. Control	Magazine No. Test	Cyclic Rate, Rds/Min. Control	Cyclic Rate, Rds/Min. Test	No. Rds. Fired	Trial No.	Weapon No.	Magazine No. Control	Magazine No. Test	Cyclic Rate, Rds/Min Control	Cyclic Rate, Rds/Min Test	No. Rds Fired
1	11	-	151	-	829	20	2	12	-	151	-	935	20
		164	-	838	-	20			164	-	937	-	20
		-	176	-	850	19			-	176	-	949	20
		189	-	840	-	20			189	-	935	-	20
	12	154	-	887	-	20		13	154	-	900	-	20
		-	166	-	928	20			-	166	-	924	20
		179	-	917	-	20			179	-	910	-	20
		-	191	-	926	20			-	191	-	935	20
	13	-	156	-	913	17		14	-	156	-	900	20
		169	-	897	-	20			169	-	912	-	20
		-	181	-	908	20			-	181	-	919	20
		194	-	900	-	20			194	-	908	-	20
	14	159	-	857	-	20		15	159	-	924	-	20
		-	171	-	895	20			-	171	-	935	20
		184	-	867	-	20			184	-	921	-	20
		-	196	-	910	20			-	196	-	935	20
	15	-	161	-	856	19		11	-	161	-	867	19
		174	-	910	-	20			174	-	861	-	20
		-	186	-	930	20			-	186	-	871	20
		199	-	910	-	20			199	-	859	-	20
Average		-	-	882	894	-	Average		-	-	906	917	-

Table I-IV (Cont'd)

Trial No.	Weapon No.	Magazine No. Control	Magazine No. Test	Cyclic Rate, Rds/Min. Control	Cyclic Rate, Rds/Min. Test	No. Rds. Fired
3	13	-	151	-	906	20
		164	-	904	-	20
		-	176	-	906	19
		189	-	900	-	20
	14	154	-	902	-	20
		-	166	-	926	20
		179	-	915	-	20
		-	191	-	906	20
	15	-	156	-	929	19
		169	-	935	-	20
		-	181	-	937	20
		194	-	933	-	20
	11	159	-	863	-	20
		-	171	-	877	20
		184	-	859	-	20
		-	196	-	881	19
	12	-	161	-	942	20
		174	-	942	-	20
		-	186	-	947	20
		199	-	947	-	20
Average		-	-	910	916	-

Trial No.	Weapon No.	Magazine No. Control	Magazine No. Test	Cyclic Rate, Rds/Min Control	Cyclic Rate, Rds/Min Test	No. Rds Fired
4	14	-	151	-	910	20
		164	-	921	-	20
		-	176	-	912	20
		189	-	912	-	20
	15	154	-	928	-	20
		-	166	-	941	19
		179	-	930	-	20
		-	191	-	926	20
	11	-	156	-	869	20
		169	-	865	-	20
		-	181	-	851	20
		194	-	859	-	20
	12	159	-	935	-	20
		-	171	-	944	20
		184	-	928	-	20
		-	196	-	935	20
	13	-	161	-	917	20
		174	-	904	-	20
		-	186	-	910	20
		199	-	895	-	20
Average		-	-	912	912	-

Table I-IV (Cont'd)

Trial No.	Weapon No.	Magazine No. Control	Magazine No. Test	Cyclic Rate, Rds/Min. Control	Cyclic Rate, Rds/Min. Test	No. Rds. Fired
5	15	-	151	-	927	19
		164	-	917	-	20
		-	176	-	926	20
		189	-	917	-	20
	11	154	-	859	-	20
		-	166	-	877	20
		179	-	840	-	20
		-	191	-	862	19
	12	-	156	-	951	20
		169	-	944	-	20
		-	181	-	949	20
		194	-	937	-	20
	13	159	-	893	-	20
		-	171	-	904	20
		184	-	897	-	20
		-	196	-	915	20
	14	-	161		920	19
		174	-	919	-	20
		-	186	-	917	20
		199	-	910	-	20
Average		-	-	903	915	-

Table I-V. Firing Sequence for Part I (Five Loadings) of Function and Durability Test

Mode of Fire, by Magazine No.					Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
B	A	S	B	S	Wpn No.	Wpn No.	Wpn No.	Wpn No.	Wpn No.
T1	C1	T2	C2	T3	1	2	3	4	5
C3	T4	C4	T5	C5	2	3	4	5	6
T6	C6	T7	C7	T8	3	4	5	6	7
C8	T9	C9	T10	C10	4	5	6	7	8
T11	C11	T12	C12	T13	5	6	7	8	9
C13	T14	C14	T15	C15	6	7	8	9	10
T16	C16	T17	C17	T18	7	8	9	10	1
C18	T19	C19	T20	C20	8	9	10	1	2
T21	C21	T22	C22	T23	9	10	1	2	3
C23	T24	C24	T25	C25	10	1	2	3	4
T26	C26	T27	C27	T28	1	2	3	4	5
C28	T29	C29	T30	C30	2	3	4	5	6
T31	C31	T32	C32	T33	3	4	5	6	7
C33	T34	C34	T35	C35	4	5	6	7	8
T36	C36	T37	C37	T38	5	6	7	8	9
C38	T39	C39	T40	C40	6	7	8	9	10
T41	C41	T42	C42	T43	7	8	9	10	1
C43	T44	C44	T45	C45	8	9	10	1	2
T46	C46	T47	C47	T48	9	10	1	2	3
C48	T49	C49	T50	C50	10	1	2	3	4
T51	C51	T52	C52	T53	1	2	3	4	5
C53	T54	C54	T55	C55	2	3	4	5	6
T56	C56	T57	C57	T58	3	4	5	6	7
C58	T59	C59	T60	C60	4	5	6	7	8
T61	C61	T62	C62	T63	5	6	7	8	9
C63	T64	C64	T65	C65	6	7	8	9	10
T66	C66	T67	C67	T68	7	8	9	10	1
C68	T69	C69	T70	C70	8	9	10	1	2
T71	C71	T72	C72	T73	9	10	1	2	3
C73	T74	C74	T75	C75	10	1	2	3	4
T76	C76	T77	C77	T78	1	2	3	4	5
C78	T79	C79	T80	C80	2	3	4	5	6
T81	C81	T82	C82	T83	3	4	5	6	7
C83	T84	C84	T85	C85	4	5	6	7	8
T86	C86	T87	C87	T88	5	6	7	8	9
C88	T89	C89	T90	C90	6	7	8	9	10
T91	C91	T92	C92	T93	7	8	9	10	1
C93	T94	C94	T95	C95	8	9	10	1	2
T96	C96	T97	C97	T98	9	10	1	2	3
C98	T99	C99	T100	C100	10	1	2	3	4

Table I-VI. Firing Sequence for Part II (50 Loadings) of Function and Durability Test

Mode of Fire, by Magazine No. B	A	S	B	S	Cycle 6-10 Wpn No.	Cycle 11-15 Wpn No.	Cycle 16-20 Wpn No.	Cycle 21-25 Wpn No.	Cycle 26-30 Wpn No.	Cycle 31-35 Wpn No.	Cycle 36-40 Wpn No.	Cycle 41-45 Wpn No.	Cycle 46-50 Wpn No.
T5	C5	T10	C10	T15	6	7	8	9	10	1	2	3	4
C15	T20	C20	T25	C25	7	8	9	10	1	2	3	4	5
T30	C30	T35	C35	T40	8	9	10	1	2	3	4	5	6
C40	T45	C45	T50	C50	9	10	1	2	3	4	5	6	7
T5	C5	T10	C10	T15	10	1	2	3	4	5	6	7	8
C15	T20	C20	T25	C25	1	2	3	4	5	6	7	8	9
T30	C30	T35	C35	T40	2	3	4	5	6	7	8	9	10
C40	T45	C45	T50	C50	3	4	5	6	7	8	9	10	1
T5	C5	T10	C10	T15	4	5	6	7	8	9	10	1	2
C15	T20	C20	T25	C25	5	6	7	8	9	10	1	2	3
T30	C30	T35	C35	T40	6	7	8	9	10	1	2	3	4
C40	T45	C45	T50	C50	7	8	9	10	1	2	3	4	5
T5	C5	T10	C10	T15	8	9	10	1	2	3	4	5	6
C15	T20	C20	T25	C25	9	10	1	2	3	4	5	6	7
T30	C30	T35	C35	T40	10	1	2	3	4	5	6	7	8
C40	T45	C45	T50	C50	1	2	3	4	5	6	7	8	9
T5	C5	T10	C10	T15	2	3	4	5	6	7	8	9	10
C15	T20	C20	T25	C25	3	4	5	6	7	8	9	10	1
T30	C30	T35	C35	T40	4	5	6	7	8	9	10	1	2
C40	T45	C45	T50	C50	5	6	7	8	9		1	2	3

Note: The prefix (C) and (T) to the magazine number represents CONTROL and TEST, respectively.
The modes of fire are abbreviated: (B) for 3- to 5-rd bursts, (A) for 20-rd automatic bursts, and (S) for semiautomatic firing.

Table I-VII. Cyclic Rate of Fire Data for Function and Durability Test (Cycles 1 through 5)

Test Magazine No.	APG Weapon Number 1	2	3	4	5	6	7	8	9	10	Average, All Wpns.
4		783	831	865	869	844					
9				827	792	838	881	855			
14						825	844	823	869	832	
19	840	789						808	823	809	
24	836	758	881	893						801	
29		755	844	879	851	838					
34				825	813	834	891	832			
39						801	859	836	840	815	
44	832	768						798	818	811	
49	838	780	855	873						788	
54		755	844	871	840	847					
59				832	813	845	879	836			
64						802	871	844	838	820	
69	829	778						802	825	823	
74	842	789	855	877						794	
79		741	849	885	842	845					
84				847	829	857	883	842			
89						799	859	847	829	816	
94	831	767						815	832	829	
99	851	798	859	879						801	
Average	837	772	852	863	831	831	871	828	834	812	831

Table I-VIII. Cyclic Rate of Fire Data for Function and Durability Test (Cycles 1 through 5)

Control Magazine No.	APG Weapon Number 1	2	3	4	5	6	7	8	9	10	Average, All Wpns.
1	845	781	838	904	845						
6			792	832	818	842	871				
11					783	789	849	845	836		
16	825						825	809	811	840	
21	825	816	855						806	794	
26	823	753	832	875	831						
31			776	855	832	825	855				
36					789	799	861	827	829		
41	806						825	811	820	811	
46	831	791	851						788	770	
51	820	759	836	867	836						
56			798	853	834	823	857				
61					798	820	855	825	831		
66	818						845	815	834	804	
71	825	778	855						799	796	
76	816	776	840	871	829						
81			834	885	855	842	859				
86					798	838	867	836	820		
91	820						847	811	831	801	
96	840	786	869						811	825	
Average	824	780	831	868	821	822	851	823	818	805	825

Table I-IX. Cyclic Rate of Fire Data for Function and Durability Test (Cycles 6 through 50)

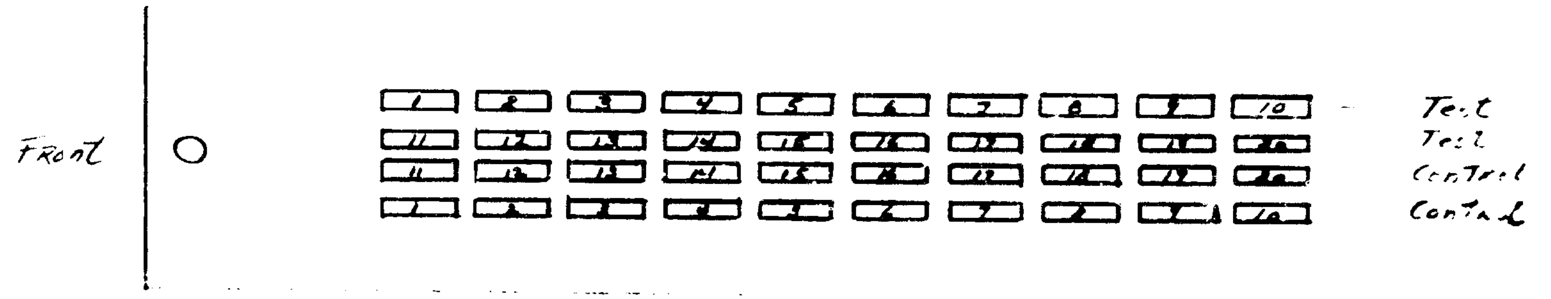
Magazine No.	Cycle No.	APG Weapon Number 1	2	3	4	5	6	7	8	9	10	Avg.	
C 5	6-15	820	806	863	919	845	851	867	822	834	853	848	
	16-25	792	801	855	887	832	853	871	834	832	801	836	
	26-35	809	804	879	902	845	869	875	851	844	811	849	
	36-45	813	806	883	904	844	857	881	847	829	825	849	
	46-50	-	808	-	887	-	847	-	840	-	829	842	
	Average	808	805	870	900	842	855	874	839	835	824	845	
C 30	6-15	816	825	863	879	853	831	881	829	842	792	841	
	16-25	806	798	873	877	845	855	871	822	832	79[illegible]	837	
	26-35	809	811	877	897	853	840	879	851	845	816	848	
	36-45	802	809	871	906	851	871	87[illegible]	842	840	838	851	Average,
	46-50	-	799	-	904	-	844	-	834	-	825	841	All Wpns.
	Average	808	808	871	893	850	848	877	836	840	812	844	844
T 20	6-15	844	808	861	902	883	853	912	827	851	818	856	
	16-25	818	806	859	897	849	853	879	844	845	813	846	
	26-35	829	798	887	910	859	863	881	867	849	825	857	
	36-45	818	796	887	921	857	891	879	865	849	831	859	
	46-50	823	-	867	-	845	-	873	-	844	-	850	
	Average	826	802	872	908	859	865	885	851	848	822	832	
T 45	6-15	815	815	89[illegible]	893	847	857	883	834	867	823	852	
	16-25	806	808	869	902	849	861	883	840	845	809	847	
	26-35	823	802	881	902	853	875	881	847	867	842	857	
	36-45	822	791	887	908	847	881	877	853	832	844	854	Average,
	46-50	815	-	867	-	845	-	867	-	838	-	846	All Wpns.
	Average	816	804	879	901	846	868	878	844	850	830	852	842

Table I-X. Malfunction Data for Function and Durability Test (Cycles 1 through 50)

Magazine Type	Cycle No.	[a]Magazine No.	[b]Malfunction Type, By Weapon Number 1	2	3	4	5	6	7	8	9	10	Total
Test	1	23(S)									FF		1
	1	41(B)							FF				1
		Total	0	0	0	0	0	0	1	0	1	0	2
Control	5	28(B)						FBR					1
	5	43(B)		FBR									1
	25	15(B)						2FC					2
	32	20(S)						FBR					1
	32	40(B)								FBR			1
		Total	0	1	0	0	0	4	0	1	0	0	6

a: The letter in () is the mode of fire of the weapon at the time of the malfunction.
b: The malfunction abbreviations are as follows - FF (failure to feed), FC (failure to chamber), and FBR (failure of bolt to remain rearward after firing last rd. from magazine).

Note: A total of 20,000 rounds was fired with each magazine type; 100 magazines tested with 100 rds. each (five loadings) and an additional 900 rds. from ten magazines selected from the origional 100 samples. Ten M16A1 rifles were used.



The Numbers indicate firing sequence for test and control magazines [illegible]

Weapon No. 1 — Mag Sequence 1-5
2 — 6-10
3 — 11 15
4 — 16-20

Figure I-2: Diagram of Magazine Array for the Static Dust Test.

Table XI. Malfunction Data for Mud Test

Magazine Type	APG Wpn No.	Magazine No.	Mode of Fire	[a]No. Rds. Fired	[b]No. Malfunctions, by Type FS-1	FS	FC	FL	FF	DF	BOB	FFR	FJ	FBR	Total
Test	1	351	B	20							1				1
		352	A	20			1								1
		353	S	4m				1	3						4
		354	B	20			2	3	1		2				8
		355	S	20			2	9			4				15
			Total	84	0	0	5	13	4	0	7	0	0	0	29
Control	1	341	B	20				5			1		1		7
		342	A	20			1	9							10
		343	S	20			1	14		2					17
		344	B	20		1	2	12	2				1	1	19
		345	S	5m	1	2	2		2						7
			Total	85	1	3	6	40	4	2	1	0	2	1	60
Test	2	341	B	8m					2						2
		342	A	20				6		3					9
		343	S	2w			3								3
		344	B	3w			1	1							2
		345	S	3m			2		1	1					4
			Total	36	0	0	6	7	3	4	0	0	0	0	20
Control	2	351	B	20				1			1			1	3
		352	A	20			5	10							15
		353	S	4w			2	3							5
		354	B	4w		1	2	1							4
		355	S	20				4							4
			Total	68	0	1	7	19	0	0	1	0	0	1	31

Table XI (Cont'd)

Magazine Type	APG Wpn No.	Magazine No.	Mode of Fire	[a]No. Rds. Fired	[b]No. Malfunctions, by Type FS-1	FS	FC	FL	FF	DF	BOB	FFR	FJ	FBR	Total
Test	3	356	B	20											0
		357	A	20				1			1	1			3
		358	S	20											0
		359	B	9w			1	3							4
		360	S	5w				1							1
			Total	74	0	0	1	5	0	0	1	1	0	0	8
Control	3	346	B	20				2							2
		347	A	20				9			1	1			11
		348	S	20			2	5							7
		349	B	20			6	2							8
		350	S	4w			2	2							4
			Total	84	0	0	10	20	0	0	1	1	0	0	32
Test	4	346	B	20											0
		347	A	20											0
		348	S	20											0
		349	B	20				2							2
		350	S	20				9							9
			Total	100	0	0	0	11	0	0	0	0	0	0	11
Control	4	35	B	20											0
		357	A	10	1			2							3
		358	S	5w	1			1							2
		359	B	20											0
		360	S	20				1							1
			Total	75	2	0	0	4	0	0	0	0	0	0	6

a: These figures represent the number of rounds fired from a magazine prior to incapacitation of the weapon or magazine. The letter (m) or (w) adjacent to the numbers indicates the item which was rendered inoperative due to mud contamination.

b: The following malfunction types were not related to magazine performance - FC, FL, FFR, AND FJ. The primary cause of the stoppages was mud contamination

APPENDIX II - DEFICIENCIES AND SHORTCOMINGS

1. Deficiencies

Deficiency	Suggested Corrective Action	Remarks
First two cartridges loaded into the test magazine stack one on top of the other which reduces magazine capacity to 19 rounds and causes failures to properly feed (DF) which are not immediately clearable (paragraph 2.2).	Revert to the earlier follower design (round cartridge profile). Limit follower tilt (rotation about the longitudinal axis) so that premature release of the last round does not reoccur (see No. 3 below).	The cartridge profile of the follower does not allow the first round entering the magazine from the charger clip to laterally shift from center to left side.

2. Shortcomings

Shortcoming	Suggested Corrective Action	Remarks
Magazine floor plate completely separates from magazine body when the loaded magazine is base-dropped (paragraph 2.4).	Increase height of detent ball. Eliminate frontal protrusion of the floor plate below the magazine body.	The plasticity of the test magazine material contributes to this defect. Only partial separation was experienced at -65°F.
Incomplete formation of the test magazine floor plate detent ball (paragraph 2.2 and Figure 2.2-9).	Relocate the position of the die gating to ensure complete formation of the floor plate lock detent.	At present, die gating is located at the end of the floor plate opposite the lock detent. The material flow pattern created is not uniform.

3. Corrected Deficiencies

Deficiency	Corrective Action	Remarks
Last cartridge in test magazine prematurely releases from the feed lips and causes a weapon stoppage.	Change follower profile from round cartridge to rectangular profile. Increase side bearing surface on the follower.	Although this change corrected the feeding problem, it caused the deficiency related in No. 1 above.

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APPENDIX III REFERENCES

1. Materiel Test Procedure (MTP) 3 2 513.

2. Miller, Franklin H., Final Report of Engineer Design Test of Magazine, 20-Round, Disposable, for M16A1 (XM16E1), Rifle, USATECOM Project No 8 7 0200 03. Aberdeen Proving Ground. Report No. 2536, October 1967. (Distribution Controlled by Project Manager, Rifles. AD 820 840L.)

3. Drawings of Plastic Magazine Components (by USALWL):

   a. Housing, Magazine, M16, No. D4 1062-3.

   b. Spring, Compression, Magazine, No. C4-1042-8.

   c. Follower, No. C4-1042-5 (Original).

   d. Follower, No. C4-1042-5 (Redesigned).

   e. Floor Plate, No. C4-1042-11.

   f. Assembly, Plastic Magazine, No. C4-1042-6.

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Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified

1. ORIGINATING ACTIVITY (Corporate author) Materiel Test Directorate Aberdeen Proving Ground, Maryland 21005	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

ENGINEER DESIGN TEST OF 20-ROUND PLASTIC MAGAZINE FOR M16A1 RIFLES

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Report 12 December 1968 to 26 August 1969

5. AUTHOR(S) (First name, middle initial, last name)

Franklin H. Miller

6. REPORT DATE October 1969	7a. TOTAL NO. OF PAGES 118	7b. NO. OF REFS 7
8a. CONTRACT OR GRANT NO. Not applicable b. PROJECT NO. USATECOM Project No. 8-WE-602-016-002 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) APG-MT-3350 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	

10. DISTRIBUTION STATEMENT

This document may be further distributed by any holder only with specific prior approval of Commanding Officer, US Army Limited War Laboratory, ATTN: CRDLWL-6B.

11. SUPPLEMENTARY NOTES None	12. SPONSORING MILITARY ACTIVITY USALWL

13. ABSTRACT

The third in a series of engineer design tests of 20-round plastic magazines for the M16A1 rifle was conducted at Aberdeen Proving Ground by the Materiel Test Directorate from 12 December 1968 to 26 August 1969. Equal numbers of test and control magazines were subjected to a series of comparative evaluations to determine function performance characteristics and material durability at -65°F, +155°F, and ambient range temperature (+70°F ± 30°F), and in adverse conditions of mud, sand, dust, and water. The test magazine material was checked for compatibility with various nonstandard solvents and lubricants. A displacement - time study was made of the magazines to determine cartridge positioning characteristics during firing. The test results reveal that the test magazine requires further design engineering to improve performance in adverse conditions and to increase material durability ... temperature.

DD FORM 1 NOV 64 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified

Security Classification

Unclassified

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Plastic magazine (nylon, type 6-10)						
Rifle, 5.56-mm, M16A1						
Function performance						
Durability						
Environmental conditions						
Lubricants						
Positioning characteristics						

Unclassified

Security Classification